Vol. II

PLEADINGS AND TESTIMONY

Supreme Court of the United States

OCTOBER TERM, 1934

No. 255

ALTOONA PUBLIX THEATRES, INC.,
PETITIONERS,

vs.

AMERICAN TRI-ERGON CORPORATION AND TRI-ERGON HOLDING, A. G.

No. 256

WILMER & VINCENT CORPORATION AND LOCUST STREET REAL ESTATE COMPANY, PETITIONERS,

vs.

AMERICAN TRI-ERGON CORPORATION AND TRI-ERGON HOLDING, A. G.

ON WRITS OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT

PETITION FOR CERTIORARI FILED AUGUST 6, 1934.

CERTIORARI GRANTED NOVEMBER 5, 1934.

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FRANK N. WATERMAN, a witness in behalf of the defendants, having been previously duly sworn, testified as follows:

DIRECT EXAMINATION (Continued).

By MR. NEAVE:

Q. 45. Mr. Waterman, you began your testimony last evening at the hotel during the demonstrations, but at that time we did not pause to ask you who you were and what experience you have had that enables you to testify as an expert in cases such as this. Will you please state?

A. I was educated at Cornell University, where I took the degree of mechanical engineer, with special reference to the applications of electricity. Also I have the degree of master of science, obtained from the Brooklyn Polytechnic Institute, after two years further study.

From 1889 to 1900 I was electrical engineer with the Westinghouse Electric Company and its successor, the Westinghouse Electric & Manufacturing Company.

And from 1900 to date I have been acting as a consulting engineer.

So far as matters connected with the special features involved in this case, I made a special study of optical systems from the practical and from the theoretical side, the geometry of optical systems, between the years '95 and 1902.

I have been active in photography from 1891 to date.

I have made a close study and done much work on machinery of various kinds, including electric motors and generators, motion picture cameras and projectors, radio apparatus and circuits, and phonographic apparatus.

I was retained by the Edison Industries and later by Thomas A. Edison, Inc., in connection with questions relating to the recording of sound on cylindrical records, particularly in connection with the very fine thread records, where the record groove was narrow and shallow.

I also studied in behalf of the Edison Company questions regarding the construction of phonographs. Later, and with the consent of the Edison Company, I was retained by the Victor Company and did a very large amount of further experimental work in connection with the recording of lateral cut records on discs, as distinguished from cylinders; and also a large amount of experimental work in the acoustics of the cabinets, horns and sound-reproducing system generally involved in the Victor machines.

At the time when the recording of sound on wires was first brought to this country—which, if my memory serves me, was about 1906 or 1907—I was retained to make an investigation of this method of recording and its practical possibilities; and spent a number of months in experimental work, in the study of recording of sound on wires and metal tapes.

I was also retained by the Edison interests—the name of the particular concern I don't remember at the moment, in connection with motion pictures, and testified in a considerable number of cases involving motion picture cameras.

In this connection I studied in detail the operations and requirements in connection with motion picture making and projection.

In connection with radio work I have been retained by the United Wireless Company, the Wireless Specialty Apparatus Company, the Marconi Company, the R. C. A., Sparks-Whittington & Company, the Northern Electric Company, the Canadian General Electric Company.

And with regard to amplifiers, also by the Western Electric Company.

In this connection I have studied extensively, as well as devised and worked with radio circuits and apparatus—particularly I spent many weeks in the laboratory studying the thermionic tubes, which are used in radio as detectors and amplifiers, and also made a special study for a few months of the subject of loud speakers, particularly in trying to connect the definite properties of loud speakers with their causes, and work having to do with extending the frequency range of loud speakers.

Since this case has to do to some extent with musical matters, I may say that as a boy I studied the violin for many years and carried that study on continuously until I was about twenty-one.

Q. 46. You have referred to your experience in radio matters, apparatus and circuits. Are the radio apparatus and circuits used in sound recording and reproduction?

A. Yes.

Q. 47. Not as radio, but as auxiliaries?

A. Yes. Similar circuits are used, particularly circuits similar to those used in the audio frequency end of radio receivers, and in the loud speaker circuits.

Q. 48. And radio appliances, such as the tubes and so forth, are used here in the sound?

A. The appliances are largely used in common.

Q. 49. Now, will you outline the process of recording and reproducing sound, so that we may get an idea of what that involves and what has been devised, and what is used in the commercial reproduction and recording of sound?

A. I have prepared two drawings, or had them prepared, which illustrates in a very schematic sort of way the arrangement as it is employed by the R.

C. A. Victor Company apparatus for the purpose of recording.

Q. 50. Are those the two?

A. Yes.

(Two drawings presented by witness Waterman illustrating in a schematic way the arrangement employed by R. C. A. Victor Company apparatus for recording and reproducing, received in evidence and marked Defendants' Exhibits 68 and 69, the first the recording and the second the reproducing sketch.)

Mr. Neave: Defendants' Exhibit 68 is the recording sketch and 69 is the reproducing.

The Witness: Referring to Defendants' Exhibit 68, at the left is schematically indicated the studio stage with the camera below and the microphones hanging above, picking up the sound.

Next comes the so-called monitoring room, and next—at the right, the recording room, both ends being connected with the power room as indicated below.

Since the camera and the recorder are very widely separated, it is essential that there should be some means of providing synchronism; that is, they must run exactly together.

To effect this they are connected with a common source of power, and the power is alternating current.

I presume your Honor is familiar with what I mean by alternating current: it is a current in which, as the generating coil revolves past a magnet, the current flows first in one direction and then in the other. Therefore, these reversals of current tell the story of the progress of the coil in the generating machine. Therefore, if the generating machine is run at a constant speed—and

today, as your Honor is well aware, we measure time by electric clocks; these electric clocks are nothing but counters of the speed of the generating machines. These are closely regulated, so these machines—the camera and the recording machine—are driven by alternating current motors which operate in step; that is, in synchronism with the alternations, reproducing in their own motions the motions in the generating machines.

Therefore, the camera and the recorder operate together, and it is only necessary to make a signal to have the operations start together. That is done by slapsticks, or some method whereby a sound is made which is photographed and heard, and the recording of pictures and of sound start together.

Now, these microphones that are indicated at the left, hanging above the camera, are exceedingly delicate pieces of apparatus, which are capable of very accurately following the sounds produced. But in so doing are capable of giving out only an exceedingly trifling amount of energy, in the terms that we ordinarily think in, it is almost inconceivably small.

Sometimes one microphone is used; sometimes two; sometimes more; according to the distribution of sound on the stage. They are placed necessarily a considerable distance from the speakers, because they cannot be in the field of the camera. Therefore, the sound waves that reach them are less strong than they would be if the speaker spoke directly into them, as we do when we telephone—which still further reduces the energy.

Now, from the stage the current goes to the monitoring room; and there goes into a mixer. If there are several microphones picking up the sound, it is desirable that they should have the

sounds which they pick up properly blended. And so that is done by a monitor operating a mixer. He hears what is going on by a circuit brought back from the amplifier, in a little loud speaker alongside his monitoring desk. So that he hears what is being said and controls the mixture so as to give the proper effect.

From there the current produced goes to the amplifier.

But first I must point out that the energy picked up in the microphones is so exceedingly trifling that it is not safe to try to transmit it without amplification. Therefore, the microphones are rather clumsy looking things—your Honor will see at the left of these figures; that is because they have above them a two or three-stage amplifier.

In order that the signals may be, when transmitted, sufficiently large so that any minute disturbances picked up by the cables will not be predominantly large as compared to the signal, the microphone amplifiers are carefully shielded, and the cables are carefully shielded.

But it is essential to amplify immediately at the microphone, in order to make sure that disturbances are not picked up.

And then when the current goes from the mixer to the amplifier in the recording room, it is again amplified, and from the amplifier it goes to the recording galvanometer. This amplification is so large that it is really hard to imagine it. This amplifying equipment, when called on to do its best, gives a power amplification of five million millions of times.

THE COURT: Million millions of what?

THE WITNESS: Times the original signal. The power has to be increased by that much in order

to give adequate power to effect the recording. These amplifiers are complicated circuits, which I take it your Honor won't be interested in, but which represent years of development, and which progressively enlarge the signal going from stage to stage, and finally pass it out in the form of a current, representing the original voice or sound currents, and passing them to a recording system.

Before describing this recording system, I think I ought to explain to your Honor that so far your Honor heard only about one method of recording sound film, and that is by a system that makes a band of uniform width but of variable density. I believe Mr. Hoxie referred to the other kind that I now have in mind, such as might be made by a vibrating light, for example, the light growing more brilliant and less brilliant. The picture looks more like a Venetian blind, which we are looking at across the courtroom here. The other kind is known as the variable width record, and that is the kind employed by the RCA Victor Company in its recording and which is shown upon this diagram.

Q. 51. That is the kind that Mr. Hoxie testified that he used?

A. That is the kind that Mr. Hoxie employed in his work.

(Diagram of sound records received in evidence and marked Defendants' Exhibit 70.)

THE WITNESS: The diagram that looks like a ladder or Venetian blind at the right, as the exhibit is marked, represents the variable density type of record in which the sound variations are represented by variations in density of the record, and the sound frequencies by the separations of these variations of density.

At the left is shown the variable width record in which the record is made by a line of light vibrating rapidly at right angles to the length or to the direction in which the film is moving, and so producing a weirdly saw-toothed type of record—all at the left of this saw-toothed margin being black and all at the right white.

Q. 52. This Exhibit 70 might lead one to suppose that the variable density record and the variable width record were both used in the same film. One or the other is used, as I understand it?

A. That is true. That is merely because two pieces of film are laid side by side in the photograph—photomicrograph, I should say.

The records, your Honor, are very greatly exaggerated in width, as your Honor knows. The system shown in the upper right-hand corner of Exhibit 68 is the lens system which is used in making these records. I need not go into the details, I think, but at the left your Honor will see a little mirror carried by a little loop of wire. That wire is suspended in a magnetic field, and the current which I have described, coming from the amplifier, passes through this little loop, vibrates it in the field, thereby moving the mirror, the light coming from the exposure lamp through a suitable system of lenses, is reflected from the mirror, and thence through a cylindrical lens and a spherical lens, through an aperture disc, and finally through an objective on to the film. If the mirror stood still, no sound current passing, that line of light would be such that one-half of this left-hand portion of Exhibit 70 would be black and the other white. But as the sound currents pass through the loop, the mirror is vibrated, and so the lines extend more to the right or more to the left, according to the swings of the mirror.

The recording machine is a machine embodying this optical system, and has a means for passing a

film in front of the beam of light at a uniform speed, thereby recording or exposing the film in accordance with the variations in sound. The film, of course, has to be processed by development, fixing, and so forth, and thereafter prints can be made onto a picture film or otherwise, as desired.

Looking now at Exhibit 69, which shows the reproducing system, at the extreme right there is seen the horn, which is located on the opposite side of the projection screen from the audience. At the extreme left is seen the motion picture apparatus. And this is the essential characteristic of modern motion picture projection—that all of the apparatus is behind the audience, except the loud speaker, and that is in front of the audience, and the transmission does not have to be mechanically from the rear of the audience to the front, as would be the case were there mechanical reproductions by a phonograph and horn; but everything can be consolidated at the rear of the audience, in charge of an operator, and the product transmitted out as electric current, sent to the front of the theatre, and there turned into sound back of the screen.

The operating room is shown as containing two machines. This is in order that there may be no interruption of the program, and is merely the usual way. The operator, as one reel runs out, changes over by one scheme or another, to the other machine, so that the audience is unaware of the change of reel. Each of these machines shown comprises a motion picture machine incorporating below the ordinary projector a sound head, and also each machine incorporates a phonographic turntable for taking the sound from disc records, so that the operator uses either system, according to what is furnished him to project.

Q. 53. Just like one of the machines that the Court saw last night at the hotel during the demonstration?

A. Yes. The one that stood in the middle of the row of projectors was equipped with such a phonographic disc and was capable of projecting motion pictures either with the picture on the film and the sound on a disc record, or with both picture and sound on the film record.

Motion pictures, in this country at least, first came in a permanent way, with the projection of sound from discs, synchronously operated by a picture projector, and that system still continues, many projectors, however, being equipped so that they can transmit the sound either on the film or from discs. Similarly, there is a monitor, but that is shown as in the projecting booth. It has a small monitor speaker, so that the operator may hear what is going on on the stage and may control its volume.

There is also a large amplifier, and here again the amplification is very large. When the sound is picked up, either from the disc or from the film, the currents which are actually furnished as the result of the sound record, are very, very feeble. They require very great amplification. This amplification system is depicted in Exhibit 69, and it produces an amplification of ten thousand millions in energy.

Q. 54. In both the recording system and reproducing system, you have spoken of these amplifiers as giving enormous amplification. Was there any problem involved in that, and was there any problem involved in what I suppose is essential, that there should be that enormous amplification without distortion of the sound?

A. Yes. Problems that took many years to solve are involved in that. Where a thing is amplified many millions of times, and at each stage there is opportunity for distortion, it is only by extraordinary faithfulness that the result can come out even in recognizable form.

In this apparatus it was a very long process, producing microphones which transformed sound waves into current waves without such distortion that when amplified the results were not objectionable. Then the circuits, particularly the transformers, had an enormous capacity for distortion. The process of developing circuits free from distortion, particularly the transformers free from distortion, has been a very long and a very painful one. The tubes used in amplifying are not willingly distortionless amplifiers. They have to be circumstanced, built and circumstances in circuits built and adjusted with great precision in order to avoid introduction of foreign sounds, or what we call distortion, into the sound picked up, and since any sound or distortion impressed in a particular stage of amplification will be amplified in the next stage and have added to it all the distortions that the next stage adds, and so on through, the output of some of the early amplifiers did not bear any close resemblance to what was attained in the end.

Then, with the need for making the sound audible over a large audience room, there came the problem of what is called power amplification; that is, the currents required to operate the speakers became of an altoget er different order of magnitude from what was required when they were merely to be heard through head phones or through loud speaking telephones used or susceptible of use in a small room.

When the loud speakers had to give a very much greater sound than was possible to get from any of the old phonographs, even the best, it became necessary to have power tubes in order to handle this current. The development of power tubes and their circuits, so as to be distortionless—of course, I don't mean distortionless, because they always do distort—but so as to get the distortion down to desired limits, was another serious problem, and then the turning of those sound

currents into sound waves again, air waves carrying the sound with the volume, was a problem of the very first magnitude. So that it was not until this whole series of problems that stood in the way of this art of talking picture apparatus, where the whole apparatus is behind the audience, and the speaker alone in front, that that type could come. It came when all of those accessory apparatuses had been developed and co-ordinated and could not come before.

Q. 55. Have you been familiar with and have you followed the development and the necessities of these amplifiers, these distortionless amplifiers, if I may speak of them as such, and these loud speakers?

A. I have. Very closely.

Q. 56. And does the patent in suit relate to any of them at all?

A. The patent in suit makes no disclosure whatever as to any of these matters.

Q. 57. By whom was that commercial development work done, or the work that resulted in the commercial development of the movies?

A. It was done in several of the large laboratories of the country. The General Electric Laboratory, the Western Electric or Bell Telephone Laboratory; the Westinghouse Laboratory contributed some. It has been the product of many workers over a long period, probably running from about 1912, when amplifiers were first seriously considered, down to 1926, when we first had motion pictures that had the capacities to stay.

Q. 58. I suppose you agree that it is desirable for the recording and for the reproduction of sound records, that the record shall move at as uniform a rate as possible, past the point where the sound is to be put on or taken off of the record.

A. Certainly. That is a primary requisite, understood since the earliest days of phonographs.

Q. 59. And that, if it was a problem, was only one of the problems for the solution of the commercial talking movies?

A. Yes, but it was not a problem of at all the same magnitude as the others.

Q. 60. Before we come to that—will you tell me whether a uniform motion, whether in a straight line or in a circle, is ever possible?

A. No. Uniform motion is just merely an ideal. It cannot be produced by any human agency; but what we can do is to get, if I may speak in paradoxes, we can get as nearly as we want to it, if we want to spend the money, but we cannot get it perfect.

THE COURT: That is true, probably, of all sorts of motion, isn't it?

THE WITNESS: Yes, absolutely, your Honor.

Q. 61. Now, I want to inquire whether there was any problem in producing this approximately uniform motion of a film or of anything else. What was the long recognized and ordinary way of approximating to a uniformity of motion?

A. Rotating of a sufficiently heavy mass. That is the way, known since the earliest days of machinery. The utilization of inertia or momentum.

Q. 62. That is a flywheel I suppose you are talking of, or a balance wheel?

A. Flywheel or balance wheel, whether so-called or whether embodied in gears, the rollers, or what-not, of the machines. All rotating parts that are balanced of course are momentum furnishers, tending to produce constant speed.

Q. 63. What is it that a flywheel does and is the thing that it does, dependent upon the kind of thing it has attached to it?

A. Yes, of course. What a flywheel does is always to store up kinetic energy when its speed is increased,

and to give up kinetic energy when its speed is decreasing. Kinetic energy is merely energy of motion. A flywheel running at constant speed, if such a thing were possible, would be an absolutely useless piece of apparatus. When the speed changes, however, then the speed of the flywheel can only change as it gives up or absorbs energy. Energy is a function of its rotative speed. If when a machine is in operation, rotational operation, the force that it has to overcome increases, or the force that moves or the force that keeps it going, that is, supplies the friction of the machine, decreases, then obviously if there were nothing there to prevent, the speed of the machine would have to decrease in exact proportion, for every part of the machine has momentum. And if those parts are not enough, then it has been customary from the earliest days to apply a part known as a flywheel, or a balance wheel, in which at a given speed, a given amount of energy is stored to prevent the change of speed resulting from some change of load or of driving force, from producing as great a change of speed as would otherwise occur. Load increases, driving force decreases, speed decreases some but not nearly so much.

Now, whether the decrease is a little bit or a little bit more depends upon whether the flywheel is large or not quite so large, and the laws governing the design of flywheels have been known since a much earlier date than I am able to recall.

Q. 64. Can you refer to some early publications?

A. I looked up my old college textbook, which stands in my office library, entitled "A Manual of Machinery and Millwork," by Rankine, dated—this that I have is the fifth edition, Charles Griffin & Company of London, 1883. There is a large amount of matter, of course, in such a book, that deals with the question of speed fluctuation, speed regulation and the like.

On page 407, Section 2, entitled "Of Flywheels," and paragraph 357, a discussion of Periodical Fluctuations of Speed is begun, ending in the usual mathematical development by which we learned how to calculate the required size of flywheels for any condition.

This states:

> "Periodical fluctuations of speed in a machine are caused by the alternate excess and deficiency of the energy exerted above the work performed in overcoming resisting forces, which produce an alternate increase and diminution of actual energy, according to the law explained in Article 330, page 373."

Then it deals with how to determine the fluctuations of speed, and establishes what it calls a "coefficient of unsteadiness." Or, in other words, a mere arithmetical expression for how much speed variation you are going to tolerate—one per cent., two per cent., three per cent., half of one per cent.

Then on page 409, paragraph 358, on the flywheels:

> "A flywheel is a wheel with a heavy rim, whose great moment of inertia being comprehended in the reduced moment of inertia of a machine, reduces the coefficient of fluctuation of speed to a certain fixed amount, being about one thirty-second for ordinary machinery, and one-fiftieth or one-sixtieth for machinery for fine purposes."

The trouble with reading your textbook is that it uses technical terms.

The reduced moment of inertia is the moment of inertia of all the rotating parts of a machine, calculated as applied at a particular point.

And what the author says is, determine what total moment of inertia is required, take the moment of inertia of all the rotating parts and put the difference

into a flywheel, so as to get your one per cent. or two per cent., or whatever per cent. constancy you want.

I note on page 410, about the middle of the page, it is stated:

> "The rim of the flywheel of a factory steam engine is very often provided with teeth, or with a belt, in order that it may directly drive the machinery of the factory."

Elsewhere in the book it is pointed out that the flywheel may be a gear, it may be any part of the machine for which it is suited, and simply have inertia enough built into it.

The expression "Moment of inertia" I think we need not bother to define in its rigid technical meaning. It is just the weight of the wheel multiplied by the square of its radius of gyration.

Its radius of gyration is the point where you could put the whole weight and get the full effect out of it in swinging.

Therefore, the moment of inertia is the effective location of the weight for the purpose of storing up energy. It is ordinary, for example, to construct a flywheel with a heavy rim, and lighter spokes; because when you put the weight way out at the outer part of it, it is more effective in keeping things going. If you try to slow it down, the leverage, so to speak, which that weight has in turning the shaft is greater.

That is what moment of inertia signifies.

The other factor is angular speed. The energy stored in the flywheel will depend upon its moment of inertia—that is, the effective location of its weight—and upon the square of its angular velocity.

Thus, if we double the speed of a flywheel we multiply its energy by four—four times.

Q. 65. The last full paragraph on page 409 of this publication seems to me of interest. Will you refer to it?

A. "The fluctuation of energy may arise either from variations in the effort exerted by the prime mover, or from variations in the resistance, or from both of those causes combined. When but one flywheel is used, it should be placed in as direct connection as possible with that part of the mechanism where the greatest amount of the fluctuation originates; but when it originates at two or more points it is best to have a flywheel in connection with each of those points."

What that means is that it is common in machines to find a cumulative building-up of speed variations, so that a certain point behaves as though it was subject to many erratic tendencies to speed fluctuation.

What the author says is there is the place to put the flywheel, or he says if that sort of thing happens at a number of places, then it is better to put in two or more flywheels so as to smooth out those cumulative fluctuations of turning effort.

(Title page and pages referred to of booklet "A Manual of Machinery and Millwork," by William John Rankine, received in evidence and marked Defendants' Exhibit 71.)

Q. 66. Now, will you come to the application of flywheels in connection with uniformity of motion of sound records, in the production or the reproduction?

A. Well, these general rules which I have just referred to, applied to all sorts of machinery. They apply to sound reproduction or picture projection exactly as they do to the machinery of other kinds.

I mean that if the machine involved is something very crude, like a stone crusher, then one degree of fluctuation might be allowed. But if it is a refined apparatus like a chronograph, high-speed chronographs, where the maximum of precision is required, or if it is an oscillograph, where the fluctuations, such

as sound fluctuations have customarily been recorded before there came occasion to record them for phonographic purposes, then the flywheel is proportioned so as to give exceedingly minute variations of speed.

And it is all a mere matter of arithmetic, and then of supplying the necessary metal properly disposed.

The understanding for the necessity of the constancy of speed has been common from a very early date.

For example, it is very clearly announced by Edison in his early works. Of course, others had recorded sound for scientific purposes long prior to Edison. But Edison, so far as I know, was the first who recorded sound with the definite and avowed object of reproducing it and a knowledge of how it could be reproduced.

I think perhaps I might just recall the fact that sound has numerous attributes. It has a quality we call pitch. That technically means the number of condensations and rarefactions of the air per unit of time—per second; for example, middle C on the piano is 256. The note we used last evening, which was one octave above, is 512.

The sound also has quality or timbre, which in general is more difficult to define. Analytically we say it is due to the superposition of many pitches—harmonics.

Then it has loudness, which expresses the amount of energy put in, the extent to which the air is condensed and rarefied.

Now, all of these have to be recorded. And it is perfectly evident, if we are going to record them on something that is moving and we want to again move that thing to reproduce them, we have either got to move it in the second place at exactly the same variations that it had in the place, or else we have got to move it uniformly both times.

And such approximation to uniformity as is possible is the desirable way of doing it, both in recording and in reproducing.

I will just refer here for a moment to the Edison Patent No. 200,521. This is the patent in which, as far as the Patent Office goes, Edison announced his discovery. He says, page 1, middle of first column:

> "I have discovered after a long series of experiments that a diaphragm or other body capable of being set in motion by the human voice does not give, except in rare instances, superposed vibrations, as has heretofore been supposed, but that each vibration is separate and distinct, and therefore it becomes possible to record and reproduce the sounds of the human voice."

What Edison discovered was that you could represent by a single line engraved in a surface the pitch, the timbre and the loudness—volume of sound. And—it is very familiar to us now. It really was a very remarkable—it really is a very remarkable fact, and it was a great discovery, whoever made it first.

Edison shows here one way of recording, his Figures 1 and 2, which consist in making a groove in a sufficiently soft material of varying depth. That is known as the "hill and dale" type of record.

Edison indented it. It is still indented where they use certain kinds of surfaces. For other kinds of surfaces it is cut with a little engraving tool, in which case the tool cuts lightly or more deeply and at longer or shorter intervals, as determined by the loudness, pitch, the timbre of the sound.

In Figure 3 Edison shows a zigzag record, or lateral record, in which the record is recorded, not by up and down motions, but by sidewise motions.

Edison cylinder records were always made in the first way, by the hill and dale cutting or indenting. His lateral, I think—or at any rate, the lateral-cutting

of Bell & Tainter—I am not sure—but Berliner, Clark, Victor Company and others, is made by moving a tool laterally while the surface rolls under it.

Edison shows one way of doing that in Figure 3.

Another way is by variable width, which is used in light recording, but so far as I know in any other form except as it enters into the hill and dale recording, is shown in Figure 4—a line of variable width is used.

Now, Edison says his machine is rotated by clockwork or other suitable motor. He says that "record may be made on paper-coated or on a sheet of metal foil."

In his second patent, 227,679, Edison deals very specifically with the question of uniformity of speed. This patent is dated May 18th, 1880; applied for March, 1879.

In the first patent just referred to, Edison says that the record should be moved regularly, and shows the record-carrying cylinder as a very large, heavy cylinder of solid metal; and the record itself is a substantially weightless piece of tinfoil.

The same is true of the second patent, No. 227,679; but Edison adds to the machine an additional mass in the form of a flywheel H, and he says:

> "In order to secure great uniformity of speed, and prevent irregularity in the movement by inaccuracies of work, dust, lack of oil, or any other source of local friction or resistance, I make use of an abnormally heavy flywheel H, upon the shaft of the phonograph, so as to prevent any trembling movement and to resist any tendency to increase or lessen the speed, for upon uniformity of speed of the phonet with the phonograph depends the accuracy of reproduction, especially in musical sounds, that depend for their tone upon the number of vibrations per second."

That begins at line 45.

The last portion of the specification also refers to the same thing.

He says: "I am aware that flywheels are employed in numerous ways for equalizing the speed of machinery. I do not claim the same, broadly. In experimenting with my phonograph I discovered that the reproduction of the sound was imperfect if the slightest variation occurred in the speed; hence the combination with the cylinder of a very heavy flywheel in proportion to the cylinder rendered perfect and reliable the action of the instrument in receiving and reproducing the sound by equalizing the speed."

Other workers in the art followed suit in this respect. For example, Bell & Tainter in their patents 341,213, 341,214, describe various methods of recording and reproducing.

Patent '213 records, for example, by the use of light, and the machine employs a heavy flywheel indicated at 8.

The same numeral happens to designate the flywheel in all of the various forms of machine shown in Patent 341,214.

I call attention to Figures 18 and 19 of that patent, where the sound is recorded on tape. That is the machine which I intended to demonstrate last night, but one of the belts got into trouble, and rather than delay I omitted the test.

The flywheel is very large, gives a very uniform motion, and the machine, as I have heard it, performs admirably on speech and music both.

Other workers——

Q. 67. There were some other Edison patents, weren't there, in that connection?

A. Yes. There are quite a lot of the Edison patents. I will come to them in just a moment. Having

started on Bell & Tainter, I will finish that up. I have one other item.

The specification refers frequently to the matter of speed.

Now, Edison had a long series of follow-up patents, as they might be called, showing various arrangements. For example, in Patent No. 386,974, he shows a phonograph driven by an electric motor, the electric motor especially designed for the purpose. He constructs a rotating member of that motor as a flywheel and describes it as such. For example, page 1, line 51. And page 2, lines 12 to 25; and in the next column, lines 86 and following. All of these refer to flywheel. And Claim 1 refers to an electric motor as having a heavy flywheel.

Patent No. 499,879, another one of Edison's patents, constructs the motor as a flywheel. Figures 7 and 8 show it, and the specification deals with the matter at various places. For example, page 4, line 46:

"The ring armature is of considerable size, so as to act as a flywheel." This is repeatedly mentioned in the next few paragraphs.

Q. 68. It seems to me that Edison Patent No. 513,095 is pertinent.

A. Patent No. 513,095 very particularly emphasizes the great need of constant speed. He says:

> "While it is not essential in the phonograph that the speed shall be absolutely constant at all times, it is necessary for the best reproduction and especially for the reproduction of music that the speed of any short interval of time shall be substantially the same,"

I read that because it brings out a point I want to make. It is very evident that if, for example, the Victor phonograph is running at seventy-eight revolutions of the turntable per minute, and after it has been

running for fifteen minutes its speed has imperceptibly fallen to seventy-seven or risen to seventy-nine, nobody would know it. But if, during a single revolution, it varied that much, it would be destructive to the musical effect. That is what Edison means. The thing that is important is the flywheel effect. As he goes on to explain: Which prevents variations of the speed during short intervals.

So we recognize, in connection with that musical reproduction, two sorts of speed constancies; one is constant average speed, which is important if the note is to stay at the truth pitch, or if the music is to stay at the true pitch; and uniformity of speed, which means that there shall not be speed variations from instant to instant, which merely garble the music.

Now, the governor is a device that serves both purposes. The purpose of a governor—and it is shown in some of these Edison patents that I have been referring to, is to maintain a constant average speed, and also to add flywheel effect to maintain uniform speed. When the governor is acting, the machine is at speed, the balls have expanded to such a position that they are definitely applying the brake. There their position is practically fixed. They do not change their radius to any appreciable extent. They are acting as flywheels to the full extent of their expansive weights. It would be better, from the mere flywheel effect, if they could expand and contract, because when they expand on an increase of speed, their flywheel effect thereby becomes greater. They absorb more energy, and the change of speed is less; and vice versa on a diminution of speed, they contract and give up energy the faster.

For flywheel purposes it would be ideal if they did expand or contract. But as a matter of fact, they act like any flywheel. They are of fixed dimensions when they are actually governing, and they govern for

two ends—constant average speed to maintain, let us say, in the Victrola at 78 r. p. m., and for instantaneous speed to prevent this varying during each revolution.

Q. 69. And this that you have just been saying about governors applies not only to the Edison machine which speaks of governors and which was relative to the cylinder machine, but does it apply to the other machines that we have had here in the last few days, that have governors on?

A. Yes, sir.

Q. 70. And is this question of average speed and little variations, does it apply to films as well as cylinders?

A. Absolutely. In the same way. Governors serve the same purposes in all cases, and the only constancy of speed that the engineer can deal with is the speed of a rotating member. If a record on a turntable shifts, then the constant speed of the record is not preserved. We put on felt so that it won't shift. If the film is passing over a roller, it is the roller that is maintained at constant speed, and the film is only maintained at constant speed if it sticks to the roller. So it is incorrect to say that one gives to the record the properties of a rotating mass unless you do as Edison did and just fasten your film to your cylinder, which Edison did in his first machine. He took a light foil, having no weight, substantially speaking, and fastened it to the roller. He gave to that foil the properties of a weighty mass, but when the film is rolling over a roller, you can only do that to the extent that you keep the film to the roller, because it is the roller that has the constant speed.

Q. 71. Were there other early inventors other than Edison in the phonograph art who used flywheels to secure uniformity of motion?

A. Yes, sir; there were many others. Berliner was one of the best known of the early workers, and I refer

to the Berliner Patent No. 534,543. He shows the machine having two flywheels. He shows the machine as hand-driven and hand-cranked, as provided by the flywheel 80 referring to Figure 3. Then the mechanism which drives the turntable is provided with the flywheel 77. And the turntable itself is made heavy and is a flywheel. So that Berliner thoroughly protects the machine against variations of speed.

Another patentee is Clark. I will refer to Clark Patent No. 597,875. Figure 1 is a good illustration. Again, this has two flywheels in addition to the turntable. There is the flywheel B to which the crank is attached; the flywheel D′ on the driving shaft, and the turntable itself. Also this machine has a fixed governor shown at G.

The specification deals with the matter of having a regular smooth speed.

Another worker in this art was J. W. Jones, Patent No. 602,453. That also shows a machine having two flywheels in addition to the flywheel effect of the turntable.

Q. 72. And in the Jones Patent No. 605,484, the turntable carrying the record disc is itself made to serve as a flywheel?

A. Yes, in patent to Jones No. 605,484, Jones points out, page 1, line 56, that the turntable not only is a support for the disc but "is made of sufficient weight and thickness to act as a balance or flywheel to more readily act in conjunction with the governor to regulate the speed of the machine."

That is very aptly expressed. The governor maintains average speed and, through its gearing, to maintain uniform rotation as well, and the turntable being constructed as a flywheel cooperate in giving the desired approximation to constancy of speed.

There were a vast number of other workers. I won't stop to refer to them. I will refer to one later

dealing with cylinder and disc records. I will refer to Underhill Patent No. 995,390.

This patent is a little bit formidable looking. It is really simple. It looks formidable because it is a machine which automatically changes records. You put in the machine as many cylinder records as you want, and the machine automatically changes them and keeps on playing.

Figure 1 of Underhill shows the construction well. In this figure at the left is a very heavy flywheel g8, driven by a belt g'.

Q. 73. I believe that all of the patents that you have referred to up to this time, except the Bell & Tainter, are the patents that show cylinder or disc sound records. What other early patents are there in addition to the Bell & Tainter that show film records?

A. There are many. I don't believe it is necessary to refer to but a few. I will refer to the French patent to Dragoumis, being French Patent No. 472,467.

Q. 74. And there was a model of that that we had last night and that was operated?

A. Yes, sir. I showed his Honor the model of the Dragoumis, forming a loop of the film, and it was demonstrated as a part of the demonstration program. The film is seen at 8 in the drawings. The flywheel right under the numeral 1 in Figure 1. The driving belt is shown right adjacent to numeral 17. The machine utilizes an endless film provided with proper tensioning means, and gives a most excellent performance, the speed variations being very small indeed.

Q. 75. I believe it has been urged at some time by the plaintiff or its interests that in this Dragoumis patent the flywheel was far removed from what has been called the area of translation. What is your view as to that? Is it at the point of translation or far away from it?

A. Such contention would be quite unfounded, because the flywheel is right on the same shaft on which the reproducing cylinder runs, so that it is in no sense anywhere except right at the point of translation.

Q. 76. Does Dragoumis describe this as a flywheel, or does he merely show it?

A. No. Dragoumis does not describe it at all. He only shows it, but he shows it with the construction design of a flywheel, and when made in literal and very rigid accordance with the drawings, as the model which was exhibited last evening is constructed, it has abundance of rotating mass, so that it produces an entirely sufficient uniformity of speed. Your Honor heard it. I think it gave a very excellent result.

Q. 77. Does the Pedersen British Patent No. 115,942 also deal with a machine that has the sound photographically recorded on films?

A. Yes. This Pedersen patent is directed to a method of recording and reproducing simultaneous movement and sound; otherwise, talking motion pictures. It has particularly to do with the sound-recording part. The drawings are diagrammatic. The rotating sprocket is shown at b, and the light system at d, l, h, g, the lens being indicated at k. The specification emphasizes the need for constancy of speed. The specification says:

> "The sound is exceedingly sensitive to variation in rotating speed as will be noticed in any gramophone, and it is necessary to obviate this especially during the producing and the reproducing operations by providing particular large flywheels, for example,"

and so forth.

Wherever, as will be noticed in any gramophone—and your Honor has undoubtedly heard a gramophone that has run down, as the speed begins to vary it makes

a very unpleasant sound, so that we have all had abundant opportunity to observe that in the ordinary phonograph when the spring has run down. He says:

"by providing particularly large flywheels, for example."

And he uses the plural. As I pointed out, it was customary in the art to provide flywheel in phonograph machines. He is dealing with film here, and he says the flywheels should be particularly large. Also he is dealing with motion picture machines. It is universal, so far as I know, to have flywheels in motion picture machines. He says the flywheels here in the sound apparatus should be particularly large as compared also with the standard of the picture projector. Therefore, the patent makes very clear the procedure that should be followed in designing the sound-reproducing part. Make the flywheel particularly big. Make it big enough so that it serves the purpose.

I have a sketch here of this Pedersen patent, as I understand what it means. The drawing does not illustrate the flywheel, as I have already stated, but this sketch illustrates what I understand the specification to disclose.

Q. 78. The flywheel which is marked F and is in dotted lines is what you understand Pedersen describes as his location of the flywheel?

A. Yes.

Mr. Neave: I offer it in evidence.

Mr. Ward: I think the patent is the best evidence of that.

Mr. Neave: He says it is not illustrated in the patent but only described.

Mr. Ward: It is to be read in the light of what it says. It is a foreign patent, a British patent, and the disclosure is extremely vague and indefi-

nite, and I think the patent should stand for what it says and not as Mr. Waterman interprets it.

MR. NEAVE: I agree it should stand for what it says, and this is Mr. Waterman's idea of what it says.

THE COURT: Allowed.

(Waterman sketch of Pedersen British Patent received in evidence and marked Defendants' Exhibit 72.) (Remarked as Exhibit 148.)

Q. 79. You referred to the Ries Patent No. 1,473,976. That also relates to sound on film, does it not?

A. It does. It does schematically, a combination of a picture projector—I am referring to Figure 1 on sheet 1 of the drawings, left-hand side—it shows a combination of picture projector, which is designated generally at 22, and the sound head located below it, designated generally by the numeral 30, which contains a light optical system, a slit, and the machine is provided with means for carrying a film 1 continuously down through the picture projector, and then through the sound head. And the specification describes in many places the need of having a film moving at a uniform speed. I will call attention to a single place, for example, page 3, near the bottom of the first column, where it says that the film must move "continuously at a uniform speed," thus differentiating between continuous movement and continuous movement at a uniform speed, which is the thing necessary, as he points out, for sound.

Q. 80. Some of the witnesses who have preceded you have testified about a Trowbridge oscillograph apparatus, I think it was called. In that connection, reference was made to the Trowbridge Patent No. 1,447,913. Will you refer to that patent and tell me

whether it discloses and describes a flywheel and its function?

A. It does. The oscillograph, of which there are very many forms, is a means by which, so to speak, you make an electric current write its own signature. You put an electric current through a galvanometer of some kind and, either by a mirror or by causing a shadow or in some other way, you cause the current to make a record on a moving film. Now, for a true record—because all of these phenomena are functions of time—that is, they are a succession of events. If they are going to appear in their true light, they must appear related or through at uniform distances corresponding to uniform times. So it has been very customary to employ a flywheel.

I remember many years ago using an oscillograph, with which I provided a specially heavy flywheel nearly three feet in diameter, getting a very uniform motion for a very particular purpose. It is just a matter of uniformity required. This Trowbridge patent differs from other oscillographs in its details, and primarily also in the fact that it develops the film as fast as it comes through. It is provided with a flywheel to give uniform speed, and I refer, for example, to Figure 14, where the flywheel is shown at 74. It is on the shaft of the cylinder which propels the film through the machine. This propulsion roller being shown in Figure 2, and the flywheel is on that shaft.

An apparatus illustrating this construction has been described and produced in court by Mr. Duryea, one of the patentees of this patent. The patent states that a flywheel 74 operates it by the main shaft through a series of gears, maintains the apparatus at a uniform speed.

Your Honor will notice that the variations of speed culminate through the gears on this shaft that drives

the film. Therefore, according to the instructions of my textbook by Professor Rankine, that is the place to put the flywheel, and that is the place where Professor Trowbridge puts it.

Q. 81. Will you refer to the two Cawley patents, Nos. 1,878,577 and 1,825,438, and describe briefly what they show in this connection.

A. These patents relate to sound recording and reproducing. Patent No. 1,878,577 shows recording on a film which is wrapped around the large and heavy roller, and the recording is done on the surface of the roller, that is, upon the film, as it goes around the surface of the roller. The reproduction is in the same manner.

Of course, as the patent in suit points out, the roller itself can just as well be the flywheel, the rotating mass, and it is so constructed by Cawley, who explicitly states the desirability of the film being held perfectly rigid on the roller, and the roller moving at absolutely uniform speed—of course, that is too strong a word—but sufficiently uniform for the purpose. And in order that the film may be held rigidly to this rotating sprocket wheel, he has two pressure rollers, 4 and 4-A in Figure 1 and Figure 4, which press the film positively against the sprocket.

The patent No. 1,825,438, I believe, was the other one you mentioned?

Q. 82. Yes.

Mr. Ward: I do not want to interrupt, your Honor. So may I reserve all objection to the various of these patents as not being prior art, when the witness gets through with them. Are you agreeable to that?

Mr. Neave: Oh, yes, indeed.

A. (Continuing.) The Cawley Patent 1,825,438 relates to photoelectric sound recording or reproducing.

The film again is wrapped around a very large wheel and held in contact therewith by pressure rollers. The wheel as shown at 1, the rollers at 10. In this instance, recording is by means of light, and in order to accomplish that purpose the film overhangs the margin of the sprocket, as in the patent in suit, and emphasis is placed on the size of this sprocket wheel, which thereby itself constitutes the flywheel.

Q. 83. You have been speaking of flywheels used in various connections as shown in these patents. Should a flywheel have its mass balanced in any way, and what do you mean by "balance"?

A. "Balance" means that the flywheel will not, or the system to which it is connected, will not, when you rotate it and let it come to rest, have a preferred position. It should be just as willing to have it in one position as another, balanced like a see-saw.

Q. 84. Do you remember that in one of the pieces of apparatus that the witnesses have been testifying to here—I believe it was the Edison Triumph machine—Mr. Ward called attention to the fact that the flywheel had a lot of little holes bored in the flywheel, so that it did not look like a very good factory job to him. What does one make holes in it for?

A. That is what everyone does in balancing up any structure. I have done it many hundred of times myself. One puts the structure on knife edges which are very carefully leveled up, and then gives it a slight impulse, and then you see if it tends to take a preferred position. If one spot always tends to come down, one drills out a little metal on the heavy side.

Mr. Ward: You misunderstood me. I did not say anything about drilling of holes. I objected to the fact that parts had been cut out with a knife recently.

Mr. Neave: I did not know it was recently.

Q. 85. How about lead? Does a person put lead on?

A. Yes. If it is desired not to reduce the weight but rather to increase it, or if an inevitable unbalance occurs by virtue of the construction of the machine, which is very possible, and very often the case, then one puts a piece of lead on, usually casts it into a hole or around a screw, something of that kind, on that spot, and then put it on the knife edges, and then whittle away the lead until it balances.

Q. 86. I show you Plaintiffs' Exhibit 33, which as I recall is put in evidence as a Tri-Ergon flywheel. On one side of it there seems to be a lot of holes drilled. Is that the kind of thing one does to balance?

A. Exactly. That is what I have done many times in balancing up a flywheel.

Q. 87. Now, let us interrupt our examination of the prior patents for a moment, and will you turn to the patent in suit, and first will you look through that portion of the specification that is up to line 54, and tell me whether you agree with the specifications there, or whether there are any erroneous or misleading statements, and, if so, point out what they are.

A. You want the patent as published, or the original?

Q. 88. I was thinking of the patent as published, but you can go to the original if you want to. Of course, that is the original disclosure.

A. Line 54?

Q. 89. Up to line 54 is what I had in mind; but take up the original up to that point. That is up to the point where it begins to talk about the optical system.

A. The patent itself is entitled "Device for Phonographs with Linear Phonogram Carriers." There is nothing in the portion of the description so far which indicates that the record is to be made in any par-

ticular way or that it is for motion pictures. It refers to film strips, steel wires, and so forth, referring, as I understand, to strips of paper or film celluloid, to steel wires, as in the telegraphone, or any other method that would give a record that could be made in long lines. And it undertakes to contrast the apparatus of cylinder and disc phonographs with film, one ground being that the films themselves or the records themselves have inertia effects, which tend to smooth out the irregularities. It is perfectly true that any inertia effect tends to smooth out irregularities, but it is not true that these machines operate in virtue of the inertia of their records. I demonstrated that in a number of instances last evening. One, by making a record for the Edison Triumph machine of very trivial weight, and it performed, as far as I can see, as well as the heavier. I used film over a similar mandrel and it worked so well, showing that it is misleading to presume, as the patent states, that in prior phonographs it was the records which were in the last analysis responsible for the elimination of the small irregularities.

Then the specification goes on:

"In the latter case, however, that of phonographs with linear records, such as film strips, the portion of the record which is active at a given moment possesses practically no momentum to be taken into consideration. Irregularities in the motion, such, for instance, as may be caused by the projections,"—that, I take it, means the projections on the sprocket wheel—"the teeth,"—in the gears—"the belts,"—used for driving and to take up the supply reels—"the connecting places,"—that is, the splices in the film—"and so forth, or by the friction, at the guiding point,"—in other words, I think that is of some importance. The patentees divide the sources into two classes. One, those that arise from the mechanism; the other, those that arise from film friction at the guiding point. The

guiding point is illustrated as the slot. The line of light for acoustic operation is focussed on a gate through which the film travels. "the magnet,"—when the recording is on wire—"the condenser,"—assuming that the recording is done not magnetically but electrostatically as has been proposed—"become consequently very much more important with these"—that is, with films—"and thus greatly impair the periodicity of the sound recorded," by considerable amounts.

I have already expressed my opinion as to the relative importance.

I do not agree with the statements, but I call particular attention again to this division of the causes into two classes, because I think it has an important bearing on the understanding one is to derive from the drawings of the patent.

So far I have followed the original specification down to line 41 of the printed patent. Continuing is the statement of the present invention, which reads:

> "According to the present invention, this drawback which attaches to all hitherto known propulsion mechanisms for linear phonogram records is obviated by the arrangement that the light sound record has given to it at the controlling point the property of a weighty mass."

That is, as I have said, a decidedly misleading statement.

The thing over which the film rotates is the one that acquires the properties of the weighty mass, not the film.

Then he says: "This is attained by the arrangement that the support (a film strip or the like) is firmly pressed against one or more rollers connecting with a heavy rotating mass, so that the record moves

in exact conformity with the rollers and the rotating mass."

Now, one feature to be noted in the patent is that in no figure is there a film gate shown.

In Figures 2 to 6 we have a rotating surface, over which the film is passing at the time of translation. And in Figure 1, we have a surface which barely deflects the film out of line, so that the friction at that point is entirely negligibly small as compared to an ordinary gate.

Now, the patent as issued says, here, in substantially the words of the original, "This is attained by the arrangement that the record carrier (a film strip or the like) is firmly pressed against one or more rollers": Now, in Figure 1, it is pressed by dr_1 and dr_2 against the roller r_2. In figures 3 to 6, by—well, strictly only in Figure 4—by rollers e-g which press the film against a roller. And in Figure 2, by rollers dr_1 and dr_2 co-operating with sprockets V V2 which act to tension the film.

I called your Honor's attention to the fact last evening that we could get rid of some of the causes of disturbance in the operation of the model which I presented of Figures 5 and 6 if we prevented the film from flopping on the cylinder and getting out of focus. I did that by putting on what I called a "shoe." Your Honor will remember that the figure was inoperative in virtue of the oscillation set up by the spring and flywheel combined—by "inoperative" I mean for a useful purpose—and that when damping was applied to the spring, disturbances remained which were due to the fact that the film would not stay in focus, it was necessary to hold it down. Now, that occurs as a result of pressing the film by the method of the patent, shown in Figure 4, against the roller.

No machine that I know of—certainly not the R. C. A. machine—operates in that way. The film passes over a sprocket, but it is not pressed against it.

The reason why pressing the film against it is disastrous is that the film is not a constant quantity. It is one length when it is made, it is another length when it is one month old, and so on, changing with age; and the film does not change uniformly through its length—one length of ten feet may change more than the next length of ten feet. It results that in the film running over the sprockets, practically speaking only one sprocket tooth drives it at a time; and when that sprocket tooth lets go, it has to slip until it comes to another one. Now, if you are pressing it tight on opposite sides of a translation point, you are tending to cause that variation to make the film tighten and slacken between the pressure rollers. And that is exactly what it does when we come to try it out, in the model.

And that, as I understand it, is the way the invention is carried out. The patent says: "This is attained by the arrangement that the record carrier is firmly pressed": and that, so far as my experience goes, is an inoperative way—that is, I don't mean "inoperative," I mean not a useful way, not a commercial useful way.

Now that takes me up to the point of your question.

Q. 90. Now will you take up the optical system of the patent in suit. That is, I have been rather at a loss to know what the patent means—beginning at line 55—as to providing "a dependable and highly efficient optical system." What does it describe, what does it teach you as to what optical system to use?

A. There is no such statement in the original specification. And no such statement is true of anything disclosed in the original specification. No optical system at all is described or shown in the drawing. There is a fragmentary showing at "o" of a cylinder which the specification refers to in various terms. The first time it is referred to in the original

specification it says: "there is placed preferably"—referring to Figure 1—"in a sleeve h the part z sensitive to electric light, which is influenced by a light ray passing out of o and over the film."

In some way not described, a light passes out of "o" and comes to the film. That is all that is said.

And on page 4 of the original specification, in its typewritten form, is said: "The light rays required for the illumination or the transmission of light through the film are thrown upon the film in the form of a narrow line, by means of the objective o. On the reproduction, the light rays pass through the film strip and fall upon the photo cell z preferably placed in its interior."

Objective o is the extent of the description of an optical system. How the narrow light is obtained is not stated.

Certainly there is no improved optical system. They knew very well how to make lines of light and optical systems in general.

Then again, on page 6 of the translation is the only other place that specification refers, and there it is stated, in the original text: "For recording purposes, if the ryhthmically controlled light which has to be recorded needs expose the tone band only upon the coated surface, a solid cylinder d can be used, upon which the film band bears with its entire width.

"For reproducing purposes, when the light, collected by the object glass n "—May I remark parenthetically that is evidently an error for o—"to a narrow line coming from the source of light-projection traverses the film in order to get a light-sensitive element, for instance the cell z"—originally k; changed to z—"with cathode l and anode p," in the present numerals—I can't read it here: That says that there is a source of light; which is not shown or described.

There is an object glass; not described, and not

shown except diagrammatically. And then there is something that the specification calls a cell, z.

I notice that three different words are used for describing this part. In the first instance, it says, "Part z, sensitive to electric light," that letter "z" is small z.

In the second instance it says "photo cell z"; not "photoelectric cell"; "photo cell z."

In the third instance it says "cell z."

I am unable to agree with the statement to which your question refers, beginning at line 55 of the patent as issued, that any optical system is disclosed—much less a dependable and highly efficient one.

Q. 91. In so far as any optical system is disclosed in the patent in suit, does it differ from that which you have heard Hoxie and his co-workers testify to?

A. It does not.

Q. 92. And their system used a photoelectric cell as this patent seems to intimate it does?

A. That used a real photoelectric cell, yes.

Q. 93. There are no electric circuits connected with the cell shown in the patent in suit, are there?

A. None whatever. Not even by a fragment of wire. Nothing to indicate, even, that a circuit is required. Yet circuits and amplifiers were indispensable.

Q. 94. Now will you refer to Figures 5 and 6 of the patent in suit. You demonstrated last night, did you not, and showed to the Court and to the opposing counsel a model of Figures 5 and 6—I think it is numbers 5 and 6?

A. I did, yes.

Q. 95. Now what have you to say about these figures and why there are any objections to the use of the spring connection between the shaft and flywheel as there shown?

A. The specifications stated, page 6, original typewritten specification: "If the driving shaft of the tone-

film revolves merely with a low number of revolutions and if a rigid drive is used, the circumferential speed of flywheels that can be practically still utilized will, under certain conditions, not be sufficient for compensating the speed fluctuations." Paragraph. "According to the invention the driving of the flywheel axle is therefore effected with the aid of an elastic coupling, for instance a spring. This spring can be very feeble as, at constant speed, it has to overcome only the losses from friction of the driving part. As however, at the starting and running out of the driving gear, the inertia of the flywheel has to be overcome, it is advantageous to limit the play of the spring in either direction by a fixed stop." End of quote.

This seems to mean that in some cases, in view of limitations of some sort not definitely expressed, the flywheel that you can practically use won't be big enough to store the necessary energy to attain a desired approximation to uniform speed. Therefore, the patentees say, put a spring, and they say that that spring is to act as an elastic coupling between the flywheel axle and some driving source. It was not illustrated.

In the prosecution of the patent, Figures 5 and 6 were added. And they show an arm on a driving shaft a′, the arm being marked 2, and this driving shaft a′ is driven by a gear h′, and the flywheel is on a shaft 1; and the arm 2 is connected to the flywheel i′ by a spring 3, connecting one end of the arm with a pin 4 in the flywheel; and this flywheel is driven by this spring, which the specification in the portion read states is very feeble, as it has to overcome only the losses from friction. Well, such a system constitutes an oscillatory system, like the balance wheel and hairspring of a watch.

It may puzzle one at first thought to understand how a wheel can oscillate and rotate at the same time.

But it does. Of course, that does not mean it actually goes backwards. But, while rotating at an average speed—we may say of 360 revolutions per minute—it may have oscillatory variations of speed at a frequency of several per second or at any speed determined by the weight of the flywheel and the stiffness of the spring. And every such spring-mass rotative combination has a natural period of oscillation which it tends to take up; and it has been known that this period is calculable, as well as measurable, and that such a system is not operative unless some means is provided for stabilizing it if there is, anywhere in the system, something which might disturb its rotation at a frequency sufficiently near to its natural frequency so as to set it in oscillation.

Without further instruction, it is impossible to build an apparatus from the disclosure and have the work without some additional provisions. In other words, the additions disclosed makes the arrangement of Figures 3 and 4 not better, but worse.

Now, to construct a model of this, was difficult. The original specification does not—as I remember it—disclose the motion picture film at all. But I assumed that Figure 3 might be taken to be a motion picture film.

I have here a little model that I will use to illustrate first what I mean by a natural period. I have here just an ordinary turntable from a phonograph, and I have mounted it on a vertical pivot and suspended it by a spring. (Witness demonstrates on model):

Now, if I pull it out of its normal position of rest and then let go, it starts oscillating; and it will keep on oscillating until the combined friction of the bearing, the friction in the spring—the molecular friction, the air friction on the disc, together equal the amount of energy that I stored in that when I twisted the spring.

I therefore assumed that the film shown in Figure

3 was motion picture film, and took the distance between sprocket holes as a measure, and then I scaled Figures 3 and 4; in that way I got at dimensions.

And when the spring was added—I may say that the bearings shown in Figure 6 are quite inoperative, ridiculous; I therefore made bearings of a size that a machine design would call for, in order that we might find out something real about the machine, because with those bearings shown in Figure 6 nothing could have been found out. The bearings even in Figure 4—Figure 3, are inadequate.

And when I added a spring of such proportions that the arm 2 stayed between the stop pins 5, I found that oscillations were set up which sometimes died down and sometimes don't, which, when they die down, start again without warning at any time when a splice happens to go through or something occurs to disturb. And so I applied damping means for experimentation, to see what would happen. And in the damping means I followed the suggestion of a French patent, and I wrapped the spring.

Now, the other half of this model which I have just referred to contains a similar turntable, suspended by a similar spring, but I have just wrapped the spring with ordinary friction tape. The friction of these bearings is considerable; consequently this system does not oscillate very long in any case. (Witness demonstrates on model.)

But I am now going to turn both of these wheels through an angle, as nearly as ninety degrees as I can guess, and then I am going to let go of them simultaneously. (Witness demonstrates on model.) Your Honor will note that the one in which the spring is wrapped—that is, damped—comes to rest more quickly than the other.

Now the one with the wrapped spring has come to rest, while the other is still widely oscillating.

That is what I mean in saying that I applied damping. I enabled the spring to absorb more energy.

Now, it is interesting to see how a similar system, which has not the large friction of these bearings, performs, and, rather than construct expensive ball bearings, I simply have hung two little weights on a spring —and this isn't rotative motion at all, it is simply jouncing motion up and down. I am going to extend those springs, as nearly as I can identically, and let go of them simultaneously. (Witness demonstrates on model.)

Your Honor will notice that the spring which is damped almost immediately stopped its jouncing up and down—it is still swaying a little; while the other will go on jouncing for a long period. This, again, illustrates what I mean by damping: That is, giving to the spring the property of energy-absorption such as a belt has. A belt is an ideal elastic drive, because it absorbs energy while yielding. The leather coupling of the Amet patent which I showed your Honor last evening similarly furnished just the right degree of elasticity coupled with just the right degree of energy-absorption.

(Model presented by witness Waterman, "ordinary turntable from a phonograph, mounted on a vertical pivot and suspended by a spring," etc., used by him in demonstrating oscillation of spring-mass rotative combination, etc., with damped and undamped springs, etc., was received in evidence and marked Defendants' Exhibit 72.)

Q. 96. Now, will you refer to the German flywheel patent, with the same patentees as those who applied for the patent in suit; that is, the German Patent 387,058. You had last evening a model of that, which you demonstrated, did you not?

A. Yes.

Q. 97. Will you describe the patent a bit, and then tell us what the demonstration was, and how well it worked?

A. This German patent is addressed to "Device for Phonographs for Uniform Drive of the Linear Phonogram Carrier." It starts very much as the patent in suit starts, by stating the necessity for uniform speed of the carrier—it refers to magnet, light-line, sound box stylus or needle, and it distinguishes between average recording speed and instantaneous speed; that is to say, it is not only important that in the course of a whole minute a certain length of the film should have gone by—or of the record on a disc or cylinder, but, that at each instant it should be moving at the same speed. And it states that "No devices have become known which make possible an exact control and regulation." And it proceeds to describe how the patentees eliminate that difficulty.

Just before that, I note that it refers to the use of a sound record on a perforated film running off synchronously with a motion picture film. So that this patent does connect the idea of sound-recording and reproduction with that of motion pictures.

And it says that this constant propulsion velocity, quote, "is attained by coupling the recording or control place of the sound carrier (which is being moved longitudinally and which is of small mass) with a rotating and much larger mass, in such a manner that the number of revolutions of the latter, which is not subject to any rapid fluctuations, determines the longitudinal speed of the sound band."

The drawing shows in Figure 1 a flywheel m on the same shaft with the roller r_2. It shows a film f passing down tangential to this roller r_2, and between r_2 and the second roller r_1, between which the film is pitched. It also passes through a light gate, and some-

thing marked o is projecting something indicated like rays of light through that gate on to something z, which resembles the hieroglyphic used in the patent in suit for the photoelectric cell. It says that Figure 1 illustrates the invention in principle, for instance, for the reproduction part of an optical phonogram. It says f is the film, o the optical system with a bundle of rays coming from it, z a photoelectric cell. In this instance the term "photoelectric" is used. It says the bundle of rays is to be varied in acoustic rhythm, is to be expressed as I understand by its variations in intensity, the variations of sound waves in the air. It says that the guide bars ll hold the film which is driven by one roller. No roller is shown in the drawing, but in view of the reference to motion picture machines, it is evident that it means that the film is drawn through by a sprocket roller in the ordinary way that motion picture film is handled. It says: "which is driven by one roller, not shown in the drawing, exactly in the focal line."

The focal line being indicated by the crossing of the light rays in the bundle as shown. Or the guide bars are provided with a narrow slit.

Now, in the drawing as shown, the light rays are themselves projected from the objective o to a sharp focus, but the patent says that it may be so done or they may be without such focussing thrown against a narrow slit, which is formed in the guide or gate ll.

Then it makes this statement, which is important, so far as the specification has not described the rollers r_1 or r_2, nor has it described the flywheel. Now it says: "after this guiding,"—that is, after the film gate—"the film passes two rollers r_1, r_2, resting under pressure against each other," That is, the two rollers are pressed together, "one of which is connected with a flywheel mass m." Then is shown the flywheel.

So what the patentee says is that that gate may be placed either on one side or the other of the roller, which is to say that it may be driven either from its bottom or its top end, as shown in Figure 1.

I mention that, among other reasons, because if this Figure 1 is driven from the top end, it represents the sequence of elements that are found in the Radio Corporation PS16 machine which I demonstrated, in comparison with this machine, last evening.

Now, it goes further. It says: "The rollers bringing about the uniform speed can also be used directly at the control place for guiding the sound band."

In other words, it says that the light may go through the film while it is going over the roller, which is the feature that the patent in suit makes so much of, particularly in Figures 2 and 6.

It says further: "If necessary, two such devices for producing a uniform run can be provided and connected with each other by means of belts or the like."

That is shown in Figure 2 of this German patent.

Your Honor will recall that Figure 1 of the patent in suit has two such flywheels, and that the patent in suit describes them as connected together by gears or belts.

Now, this statement of the German patent goes on: "in such manner that a slight difference in rotation keeps the film, the steel band, or the like, taut at the control section (stretch) during running." In Figure 1 of the patent in suit there is this difference, that the film passes over sprockets and consequently is kept running at a speed determined as nearly as may be by the sprockets, and whatever tension, as near as may be, by the sprockets.

In this Figure 2 of the German patent the drive is apparently indicated as by a belt a, thus furnishing elastic or resilient drive, which is described in the latter part of the original specification and is illus-

trated by means of a spring in connection with Figure 6 of the patent in suit, but as I have explained, the belt is very much more effective, and is a very much effective and suitable drive if one is going to have the resilient drive at all, because it contains inherent damping.

And the specification goes on further to say that the roller r_2 or flywheel m respectively "is furthermore connected with a revolution counter and speed governor, not shown in the drawings." So that, just as in the Hoxie machine, for example, there is not only provided a flywheel as such, but in the form of speed governor which performs the two functions stated at the outset of this specification, namely, of controlling the average speed and the instantaneous speed.

Q. 98. Last night you demonstrated the machine of Figures 5 and 6 of the patent in suit, I believe.

A. I beg your Honor's pardon. I forgot to refer to that. In constructing the model, I used Figures 5 and 6, as stated. I used the dimension of the film to determine some scale of construction and, in making the model of this German Patent No. 387,058, I used a flywheel of the size that had been so determined, and I used parts that I had and put the model of the German patent in the same box that I already had for the model of Figures 5 and 6. The rollers shown in the German patent as r_1 and r_2 were made by scaling the drawing and making them in the same proportions as to the diameter of the flywheel, as they are there shown in the drawing. The specification states that they are pressed together, and so I mounted the second roller—what we have been calling a pinch roller—so that it pressed the film against the roller on the same shaft with the flywheel. I placed the gate so that it came in line with the optical system already provided, and I put such pressure on the gate as would

keep the film running smoothly through the gate and preserve it in accurate line with the optical system.

Now, in order to get the film back to the takeup reel I was compelled to take it around a roller, just an idler, and so take it back to the holdback sprocket.

I also say, as regards this model as well as regards the other model, these models contain more than the patent shows. The patent showing is wholly fragmentary. For example, it would not be anything that would be very desirable to put a supply reel and a takeup reel directly on to Figure 1, or directly on Figure 2, because of the jerk.

Now, it is old in motion picture machines to provide loops for the film, to prevent these jerks, and the original specification of the patent in suit says that such loops are to be formed as is well known in cinematography—I think that is the word—projection. So I have provided in this model the rollers performing these loops as referred to in the specifications. I might have taken this film in this German patent model, right back to that sprocket, which would have subjected it to all of the jerks, but the object of the German patent is stated to be to get a uniform speed and the film is driven through the machine by a roller. One roller I think is the language. So I provided a roller, which is accurately made, and not a mere holdback sprocket which I used to pull the film through the machine and, as I stated last night, the whole arrangement is in a horizontal position in order to get it into the box.

I would like to, if I may, call attention to that statement in the specification of the patent in suit. Near the top of page 7 of the typewritten specification as filed it is said that the free ends ff (in the corrected notation) "of the film band are preferably guided by the rollers for preliminary winding up in the manner

well known in cinematography so that they form a loop."

"Preliminary winding up" means obviously preliminary to winding up, that is, before you take it to the takeup reel and subject it to the jerks of that reel to form a loop.

The film, as it comes from the picture projector, goes through such a loop-forming mechanism, and is allowed to come down as a loose loop, to the sound head, in the case of the R. C. A. machine, and to the sound head as in the case of this German model which I made, but in the case of Figures 3 and 4, if one supposes that contrary to any disclosure that it is to be put into a sound picture machine, it would come directly to this rotating sound head or roller. Then from there it goes to a similar—after passing through the driving roll—goes to a holdback sprocket preliminary to the winding up in the reel.

It is interesting to note that this is just a regular motion picture projector succession of events. The film comes to a loop-forming sprocket and gate, and through to a feed sprocket, and another loop-forming sprocket, and thence to the takeup reel.

So that what the patentees did is to preserve the motion picture organization and its intermittent motion. That had been done by others before them, but that is what they did.

I have sketched the Ernemann projector schematically showing this loop-forming mechanism that I have just read a description of from the patent, and the succession of elements, the gate and the feed, from which it will be seen that that is just what the patentees did. They preserved the flywheel that was in the projector and simply took out the intermittent motion.

THE COURT: Is it correct to say that what was done or accomplished in the talking picture

producer or machine was to combine the moving picture with the phonograph; that is, the principle of the moving picture with the principle of the phonograph, and combine them finally on the one film, the sound and the picture and, by means of the flywheel or by some means, to make the production of it uniform.

THE WITNESS: That is exactly what was done, your Honor.

THE COURT: If I were trying to tell some layman here what it is all about, or tell a child—I am not asking a question now—would that be right?

THE WITNESS: It would be exactly right.

THE COURT: Of course, there is a lot of science and there are a lot of principles of science back of it, which of course the Court must go into. But isn't that the simple statement of it?

THE WITNESS: Simple, and accurate.

THE COURT: For instance, we know and have for a long time had the motion picture. We have seen the moving picture. And for a long time we have seen the phonograph or graphophone, and had it in our homes. Now you combine the principle of the two, and the picture and the sound are finally put on one film, which you have had offered in evidence here. Now, in the production of that talking picture, the object then was, and the difficulty to overcome was, to make the production uniform, and it appears that the flywheel was one, or the best, method of doing it.

THE WITNESS: Your Honor is quite correct, and what I was just saying was that the same flywheel that is in the picture projector, with the

function of constant motion there, performs the function of constant motion in the sound head. The two are parallel machines.

THE COURT: Of course, now what the Court will be inquiring about and what is in its mind will be just what, in this whole thing, what is the specific improvement contended for by the plaintiffs and their patent in suit, and whether it was valid, and whether there is anything in the defendants' usage which infringes on a valid patent of the plaintiffs. I am only inquiring as to the fundamental questions.

MR. NEAVE: Of course, there are a great many sub-questions that arise in coming to that end.

THE COURT: I realize that, Mr. Neave. I realize that fully. Unless there is something else, we are going to adjourn here. I realize there is a great deal in it which is important and it means a lot of study for the attorneys and for the Court.

Q. 99. Mr. Waterman, at the close of the session yesterday you were speaking of the picture projectors which had a constantly rotating shaft acting upon intermittent. And will you please finish what you have to say about that. And in that connection, following it, bring up those forms of picture projectors in which there is no intermittent but in which the film travels continuously.

A. I was referring to a schematic view of the Ernemann projector which, as I understood the testimony, was one that Dr. Engl used in the construction of certain of the machines referred to. And I pointed out that the statement in the patent, with regard to the formation of loops in the film was well illustrated by this schematic diagram, and that the Figure 4, with respect to which that statement was made, was in

effect simply the adoption of the mechanism of the projector, leaving out the intermittent motion element. The patentees, however, were not the first to make that change. There is another well known type of motion picture projector in which the film does not stop for each picture projected, but which by a system of moving lenses the film is to be moved continuously and at the same time have the picture stand still on the screen. Such a patent is that to Holst 587,527.

Referring to Figures 1 and 2 of this patent, the film is seen to pass from a reel at the top through the gate over suitable guide roller, thence over another guide roller and around a cylinder, which, as the specification says, may or may not be provided with teeth. The shaft of this cylinder is h′, and looking at Figure 2 the shaft h′ is provided with a very large flywheel j and a pulley in addition for driving the machine by means of a belt.

The specification, line 74, says: "j is a flywheel attached to the shaft h′ for obtaining regularity of movement, and k is a pulley by which the power of the motor—say, for instance, a small electric motor—may be applied to the apparatus through the medium of a belt for operating the same."

There are two different points in the specification, page 1, line 30. And the top of page 2 also refers to the sprocket teeth.

There are other patents of this same type that I might refer to. One, I will not take time—but simply to mention the name—patent to Momyer, No. 1,317,450.

Q. 100. The other evening at the hotel you demonstrated the operation of a device of Figures 5 and 6 of the patent in suit, and then in one of the tests that the Amet attachment was substituted for the spring arrangement of those figures. Now, will you refer to the Amet Patent No. 1,221,407, showing that spring drive that is attached there.

A. The Amet patent inquired about shows in Figure 1 a motion picture machine, the shaft 37 of which projects through the wall of the machine. It also shows a phonograph indicated generally at 5, of the cylinder type, whose shaft 17 is aligned with the shaft of the camera. A resilient drive, consisting of a hub having leather discs fastened to its two sides, each disc being provided with a coupling hub, and this resilient drive device unites the two abutted shafts m. The shaft 17 of the phonograph is provided with a large flywheel 32, which is placed immediately adjacent this resilient coupling. A coupling of the type shown in this Figure 1 and made in accordance with the description of the specification was substituted as a drive in place of the spring described with reference to Figures 5 and 6 of the Tri-Ergon patent in suit, and found to perform exceedingly well; whereas, the machine with the drive described in Figures 5 and 6, was quite inoperative for any useful purpose.

When the spring was removed and the Amet resilient drive was substituted, the performance was excellent, being in fact substantially such a performance as the alleged infringing machine PS1 gave. After a disturbance, or upon starting, the machine oscillated once or twice and then settled down. The instructions for the adjustment of the PS1 provide that it shall oscillate three times and then settle down. Thus the performance of the Amet drive was almost exactly that of the R. C. A. machine PS1.

Without quoting, I refer your Honor to page 1, line 92 in which the patentee states that he considered himself a pioneer on this type of elastic or resilient drive; and also to page 2, line 18, and page 3, line 63, and the following context in each case.

The reason why this drive performed in such an excellent way is that it has just the desired useful resilience, but in an inherently damped form, and your

Honor will recall that after the very bad performance of the model of the patent, the spring was removed, and what I called a damped spring was added, which gave a satisfactory performance.

This Amet patent provides just such a damped resilient driving member.

Q. 101. In that same series of tests you, after substituting the Amet attachment for the Tri-Ergon spring attachment, substituted the Constable attachment for that Tri-Ergon attachment. Now, will you refer to the Constable patent, which shows that attachment, No. 1,425,177.

A. The Constable patent, a complete model of which I also demonstrated and explained to your Honor after the test, is essentially a dictation phonograph, and it is provided with a resilient drive form of U-shaped spring, and with stops so as to limit the motion of the spring in starting and stopping. The construction is shown in Figures 1 and 2 of the Constable patent, where the springs are shown at 12, engaging with the sides of recesses cut in the spider of the mandrel carrying the record.

The stop means consists of a pin 14 co-operating with the two sides of the recess in the spider.

A driving member constructed in exact accordance with the showing and description of the Constable patent was made to fit in to the model of Figures 5 and 6 of the patent in suit; and after the test of the Amet device, the latter was removed and this Constable drive put in its place. The Constable drive drove the model in quite a satisfactory manner. The oscillations due to disturbance dying out after perhaps three or four oscillations; the performance in this regard being essentially the same as that of the defendants' machine PS1.

The Constable patent contains a most excellent description of the reason for this performance and the

utility of the spring. And without quoting it, I refer your Honor to page 1, beginning at line 80 and extending to about line 100.

Q. 102. You have informed me that other resilient or spring drives of this same general character are shown in the following patents: Galley 210,249; Holst 587,527; Wood 724,645; Lanchaster 1,085,443; Ebling, 1,255,143; Rowland 691,667; Jamieson—British Patent —2814 of 1884; Baron—British—21,371 of 1898; French Patent 414,788, and French addition, 10,377; is that right?

A. It is.

Q. 103. Now, in the patent in suit there is something that is spoken of as the arcuate bending of the film at the point of translation. Will you refer to the Edison British Patent 1644 of 1878 and to the Bell & Tainter Patent 341,214 in that relation.

A. I have already referred to some patents illustrating this feature. For example, the Pedersen British patent, which provides a particular heavy flywheel for the purpose of producing uniform motion of a film wrapped around a sprocket and on which sound is recorded by the action of light, a sketch of which I produced yesterday, representing my understanding.

This Edison patent inquired about, No. 1644 of 1878, shows in Figure 57 perforated film driven by a sprocket, the record being put upon and taken off from the film on the sprocket and the film being curled around as in the Pedersen patent and as in the patent in suit.

Your Honor will recall that I demonstrated the so-called Edison Skeleton machine, in which I simply slipped a very lightweight sprocket on to the normal mandrel and then hung a loop of film over it with a record pressed into the film and the device operated very satisfactorily. I also call your Honor's attention to Figure 33, showing that such an endless record strip,

in which the translation is on the cylinder, as in the patent in suit, illustrating the arcuate bending inquired about.

Q. 104. Did you refer to the Bell & Tainter in this answer just now?

A. I didn't understand your question.

Q. 105. Did you refer to the Bell & Tainter in this answer here just now?

A. No. Did your question include it?

Q. 106. That is 341,214.

A. 341,214, which I have already referred to, shows in Figures 18 and 19 the phonograph for the recording and reproduction of sound on to and from a tape record. The tape record is wound on a supply reel and wound off onto a takeup reel. These reels are shown at T and U, and in passing from one to the other it passes over a circular roller S, as seen in Figure 19. The film therefore being bent arcuately around the roller, and the point of translation being at the middle of the arc of contact with this roller. A heavy flywheel 8 is provided to give uniform motion. It is therefore just such an arcuate bending as it referred to in your question.

Bell & Tainter described the record carrier as paper having a paraffin coating. In the model which I had and which I showed your Honor the other night, it was a narrow strip of celluloid with the record pressed into it. A piece off from one of the films for that was given to the defendant at its request.

Q. 107. You have informed me that this arcuate bending is shown also in the following patents:

Bock, 364,472; Oxley, 458,916; Randall, 502,382; Cooley, 551,946; Ader, 565,567; Holman, 939,692; Chabeault, 1,135,436; Anderson, 1,246,217; Terwilliger, 1,256,613; Alber—Swiss patent—85,751; is that right?

A. It is.

Q. 108. Now, will you refer to selenium cells and to photoelectric cells and describe briefly their characteristics, and tell me whether photoelectric cells were old and what, if anything, delayed their coming into commercial use.

A. The cells are both very old as compared to any date of interest in this patent.

The selenium cell is ordinarily made by interleaving wires and putting a thin coating of molten selenium on them. This cell acts by change of resistance when it is exposed to light and, until comparatively recently, it was the form of light responsive device ordinarily employed in electric circuits, because of the much larger current that it was able to give from a given light stimulus.

The photoelectric cell has been known for a good many years, and the photoelectric property on which it is based much longer. This photoelectric effect, as it is called in electric literature, is the emission of particles of electricity from certain substances under the stimulus of light. The alkali metals, potassium, sodium, beryllium, give off more electricity for a given light stimulus, and the cells for using this property so-called are merely a means of protecting the surface and permitting the air to be exhausted, and an indifferent gas, that is, one which will not attack the surfaces, substituted. They are used either with vacuum or with an inert gas of some sort.

The selenium cells are also similarly enclosed in protective glass envelopes oftentimes.

The photoelectric cell gives off such an exceedingly minute amount of electricity for any easily imparted light stimulus that practically it was not available for use until very powerful amplifiers were developed which were capable of giving many millions of times amplification without introducing distortion.

I have called your Honor's attention to the fact that in the R. C. A. recording system the energy amplification is of the order of five millions of millions of times in order to get this small current given off by the cell under light stimulus to a sufficiently large current to effect the recording.

I will not take the time to refer to patents showing the selenium specifically, although I am going to refer to the Duddell patent, which does mention selenium. First, the work with photoelectric cells done by Dr. Story and Mr. Hoxie has already been explained to your Honor here in court. The Duddell British Patent No. 24,546 of 1902, describes recording of phonograph records on a uniformly moving film by means of an oscillograph in essentially the manner which I have described with respect to the practice of the R. C. A. Company; that is, a light shines through a suitable lens system and diaphragm on to a mirror and is reflected therefrom through a cylindrical lens, bringing it down to a fine line of light, and then through a slit if desired, but not necessarily used, on to the film. And the record is, like the R. C. A. record, of the variable area type, namely, like the left-hand record in Exhibit 70. Figure 6 shows this arrangement in the Duddell patent and Figure 7 shows the reproducing arrangement. The film having been developed and the record of variable area having been mounted suitably for continuous uniform motion past a point of translation lights from a lamp passing through a lens system L; then through a cylindrical lens, which brings it to a fine bright line of light, as described in the specification at various places, for example, page 3, line 30, and again at page 3, line 37, and through a diaphragm d′ if desired, thence through the film and onto a cell, which the specification says at page 4, line 33, may be "a selenium cell or other photoelectric apparatus." And the specification de-

scribes this as "suitably enclosed," so that it is not illuminated by any other source than the light which comes through the film. The specification also states, page 4, line 53: "In place of the selenium, I can also use other photoelectric apparatus." The only other suitable photoelectric apparatus that I know of would be to make use of the photoelectric effect, namely, the photoelectric cell.

The specification also points out the necessity for uniform motion of the film. For instance, at the bottom of page 3 he states, speaking of the film moving, "steadily uniformly from one of the drums D, D′, to the other by any of the well known means." Duddell recognized that this problem of producing not only steady motion but uniform motion was one that was continuous and uniform and was something entirely well known, and the well known means for attaining such motion being, of course, the flywheel.

I will refer also to paper by Rankine, published in the Proceedings of the Physical Society of London, Volume 32, December, 1919, to August, 1920, page 78—where Rankine shows many pictures of variable density or ladder or venetian blind type of record made by himself, and fully describes how the records were made.

Figure 1, for instance, indicates a fluctuating light beam being received by a lens L, and focussed on a slit S, and again the image of this slit focussed in a fine line on the moving film in the camera. He describes the work done rather fully, and in Figure 3 discloses a system for reproducing. This consists of a source of light marked "arc" at the left, focussed through a suitable condenser on a fine slit, the image of which is projected by a lens upon the moving film and the light passing through actuates the selenium cell back of the film.

Q. 109. Selenium cell?

A. Shown in Figure 3, yes.

Q. 110. You have some early patents there, have you not, on the photoelectric cell?

A. Yes.

Q. 111. All that is necessary to do is to list them.

A. The Langmuir Patent No. 1,273,627, which was applied for February 5th, 1914, shows a photoelectric cell at 1 in Figure 1, coupled with a pliotron type of amplifier shown at the left of the circuits that I will not describe.

This is described by Langmuir as for the purposes of photometry, and is being excited in the figure by a lamp 5, the light from this lamp causes electricity to be given off from 2, and this operates to actuate the amplifier shown at the left.

Q. 112. Just list whatever other patents you have on the photoelectric cell, without describing them.

A. Kunz Patent 1,381,474 and Compton Patent 1,567,424, describe two forms of photoelectric cell and how to make them.

Q. 112. Now, will you cast your mind back to the demonstrations at the hotel the other evening, and I would like to have you describe what you have heard during these various demonstrations. Do not describe the apparatus, because it is sufficiently listed in the program and in what was said during the demonstrations. I suppose you would have to take up each one of the runs separately. But if you could, group them and say what they were for and what they showed you as you listened to them.

A. The first test was a mechanical reproduction by the Edison Kinetophone of two records known as "The Watson" and "The Minstrel" records, in evidence.

The sounds produced by the Watson record—which according to the evidence was worn out—was

not loud enough for anything other than a rather small room.

The sound from the newer record, which is known as the Minstrel record, however, was, I should judge, of sufficient volume so that it could be used in an audience room seating perhaps, well, say, 100, 200 or 300 people. It was obviously inadequate for an audience room seating 1000, 2000 or 3000 people.

The tests under Part 2, the first test being comparisons of the R. C. A. PS-1 with the Edison Kinetophone and the Edison Triumph machine, were arranged to the best of my ability so as to eliminate every factor except speed variation; so that your Honor might judge of the constancy of the Edison Kinetophone and of the Edison Triumph machines as compared to that of PS-1.

The tests were in four series: speech, waltz, piano and a constant note of 512 cycles.

If your Honor's observation agreed with mine it indicated that there was substantially no difference in the uniformity of speed of these various machines. No one of them was perfect. All of them were thoroughly commercial.

The departures from uniformity were entirely undetectable by me during the speech rendition and the waltz rendition by orchestra; and I am not sure that I detected any in the piano. Of course, with the 512 cycle note, all of the machines showed some variations.

I am unable to say that one machine was better or worse than another. All were good.

The second test, which compared the PS-16 with the German early flywheel Patent 387,058—which is also of what we call the pinch roller type—showed with the various types of reproduction speech, music and constant note—how the performance of those machines compared.

I may or may not have made it clear to your Honor the other night that in the PS-16 machine the film itself drives the cylinder and the flywheel; in the German Patent 387,058 the film itself drives the cylinder and the flywheel. In both the sound is taken from the film by a gate or at a gate through which the film passes and on which the light is projected. This test showed that if there was a difference between the two machines, the model of the early German patent was the more constant.

The third test was with the PS-1 alleged infringing machine operated in its normal condition—that is, with the flywheel spring combination damped, and second, with it undamped. By this I mean that the drive in this machine consists of two springs driving a flywheel, the springs being coiled springs like the hairspring of a watch, and the flywheel corresponding to the balance wheel of a watch. It is an oscillatory combination and is useful for such a drive only when combined with suitable damping means.

The damping means employed was a large felt washer, pressed by a strong spring against the smoothed face of the flywheel and kept lubricated so that the friction was that of a well lubricated surface.

The test showed that the machine was entirely useless with the damping removed, but operated commercially well when the damping was applied.

(Informal discussion off the record.)

A. (Continuing.) Tests were then made with a model of Figures 5 and 6 of the patent in suit. This figure provides a flywheel driven by a spring, and I have already discussed it and will not repeat it now.

The test was made with a model exactly as described in the patent, and the machine proved thoroughly inoperative.

To illustrate what the effect of damping would be I employed a damped spring, which was damped after

the manner described in a French patent—by restricting the freedom of action of the spring, and the model then operated fairly well. I have already stated that it operated well when driven by the Amet and Constable attachments.

I demonstrated then the Constable machine, which operated exceedingly well when operating in its normal condition as described by Constable; but with the spring clamped so that it was not in action, it operated very badly indeed.

The test of the Edison Skeleton Machine I think is already described in the record. I have referred to it also this morning. It consisted of an endless record band——

Q. 113. I don't think it is necessary to describe it, Mr. Waterman, because you described it the other night, and these particular pieces of apparatus are in evidence. If you will just tell us how each one——

I just want to know what is Item 40-48—what you heard after the introduction.

A. The film had some background noise. The results as in the Dragoumis model were also good. By "good" I mean that the speed was constant for practical purposes. Then the reel film was demonstrated. This was also an exceedingly good record, with very little background noise, and the speed was constant.

The Hoxie machine with its early film, made by Mr. Hoxie himself, was demonstrated and entirely satisfactory commercial speed constancy was observed.

The machine illustrating the French Patent No. 414,788, the patentee of which, as I translate it, is the General Phonograph Company, gave a very perfect reproduction, as far as speed is concerned.

The Victrola was one of those in general use and doubtless known to everybody and gave very perfect rendition as far as speed was concerned.

CROSS-EXAMINATION.

By MR. WARD:

XQ. 115. Mr. Waterman, for the past many years your profession has been that of a patent expert, has it not?

A. My employment has been very largely in that field.

XQ. 116. Approximately what percentage of your time or income—I don't want to know your income—but just roughly speaking, what percentage of your time or income?

A. Well, I have not done a very large amount of practical engineering work since about 1907. I presume that of the time since then, 75 or 80 per cent. has been in connection with work in litigations; not by any means all testimony, because I spend a very great deal of time in investigations in laboratories in connection with these cases.

XQ. 117. And in connection with your work as a patent expert it is customary for you to plan the attack on the patents, and you take part in the preparation of briefs?

A. Oh, no, indeed; no, I don't plan the attack on the patents and I don't take part in the preparation of the briefs.

XQ. 118. Never do?

A. I am asked sometimes to read them over after they are written, but I never prepare one.

XQ. 119. Prior to the time that you were retained in this suit as an expert, when did you examine an actual sound on film sound picture machine?

A. Do you mean in the point of view of any date, or in what connection, or what?

XQ. 120. In point of view of approximate date.

A. Oh, I did not begin to study sound on film in a very close way earlier than about two years or two and a half years ago.

XQ. 121. About two or two and a half years ago?

A. Something like that. I had followed it rather closely in the literature, but to actually go into the laboratory and study it, I did not do that until about that time.

XQ. 122. Now would you mind answering the question as to when you first saw an actual—and by "actual" I mean a commercial—sound on film sound picture machine.

A. Well, at the same time.

XQ. 123. Well, about when was that?

A. I cannot say whether it is two years or three years ago.

XQ. 124. Where was that?

A. The first time I think was either at the Paramount Studio or at the Electrical Research Products Laboratory.

XQ. 125. And you did that in connection with what?

A. In connection with the study of amplifiers for use in such machines, in connection with a litigation having to do with amplifiers and amplifier circuits.

XQ. 126. And at that time did you go into the construction and operation of the sound head mechanism, or just the amplification?

A. I went through the entire apparatus to see what the problems were, the amplifications problems, I should say.

XQ. 127. In the machine which you tested, the model alleged to be made according to Figures 5 and 6 in the patent in suit, and it also embodied the structure of Figures 3 and 4, except that the spring of Figures 5 and 6 was added, did you use a synchronous motor to drive the film through the sound head?

A. Yes.

XQ. 128. You did not use a synchronous motor to drive the defendants' alleged infringing machines PS-1 or PS-2, did you?

A. I did not have anything to do with that. Those were the machines such as are in the theaters.

XQ. 129. They were not used in either of those machines in the demonstrations we had, were they? Synchronous motors.

A. No. If I had had anything to do with those motors, I would have put on synchronous motors.

XQ. 130. Is it your testimony that you built the alleged model of Figures 5 and 6 of the patent in suit as faithfully as possible and with high class workmanship to illustrate the patent, with an honest endeavor to try and get a drive for the film involving an undamped spring and a flywheel to operate successfully?

A. Yes. I venture to say that there is not in this country another machine having equally high class workmanship, in its gears and sprockets. I am referring to the sprockets which count; not to the holdback sprockets, which are ordinary commercial stuff. These gears and the big sprockets are far too expensive to put into any commercial apparatus.

XQ. 131. Can you tell us when that model was made; approximately what date?

A. Oh, last winter. I presume probably between January and mid-April.

XQ. 132. Can you tell us what kind of bearings were used for the shaft that drove the film?

A. The same as shown in the patent in suit——

XQ. 133. I mean the material. Of what material were the bearings made?

A. The patent does not specify what materials——

XQ. 134. No. What materials did you make them of?

A. So I used the materials which, in a bearing of that type, give the smoothest running, the least disturbing friction, which is hardened and ground steel shaft working in a fairly graphitic cast iron bearing.

XQ. 135. You did use a cast iron bearing?

A. Oh, yes, certainly. The finest pulleys in the world are those having cast iron bearings.

XQ. 136. Do you know what kind of bearings the defendants' machines PS-1 and PS-2 have for that shaft?

A. I think they are ball bearings. The patent does not show ball bearings.

XQ. 137. I understand that. You understand that patent drawings are not supposed to be working drawings, don't you?

A. I understand that if the question of operativeness arises, and the drawing of Figures 5 and 6 is obviously inoperative, and one wants to build a model, he will be criticized mercilessly for any departure whatever from the drawings, and that if he makes them like the drawings he will be criticized mercilessly for doing that.

XQ. 138. And you admitted that you did not make them according to the drawings? You used your best engineering judgment, didn't you?

A. I made them of the type shown in the drawings, but I did not make them of the ridiculous proportions shown in the drawings. They are quite inoperative as shown in the patent, from the bearings standpoint alone.

XQ. 139. If you just confine yourself to answering my questions rather than arguing the case, we will get along a little more quickly. Now, is it your custom as an engineer, when you see a patent, to stick to just what the patent shows, or is it your custom to use reasonable ordinary intelligence of a mechanic in building such a thing as a bearing?

A. Well, I use my own intelligence as an engineer, together with the advice of others most competent to advise, and that is what I did in this case.

XQ. 140. And yours is well above the average intelligence, isn't it?

A. When it comes to construction of bearings, I would rather have the opinion of experienced machine designers than my own; therefore, I got the advice of such men and made the bearings accordingly.

XQ. 141. And you testified that the construction taught by the patent, where the undamped spring is used, is entirely uncommercial and inoperative for sound reproduction?

A. I missed one or two words in your question.

XQ. 142. And you testified that the construction taught by the patent, where the undamped spring is used, is entirely uncommercial and inoperative for sound reproduction?

A. That is my opinion, and that is what the model showed.

XQ. 143. In connection with your criticism of the operativeness of the spring drive arrangement of the patent in suit, did you state that your reason for that is that in the mechanical system, which consists of a mass and a spring, is what is known as an oscillatory system?

A. Did I so testify? Well, you know just as well as I do whether I did or not. I don't know whether I used those words.

XQ. 144. In substance.

A. That is my general statement.

XQ. 145. Did I understand you to testify that in this alleged model of Figure 5 of the patent in suit, that you say you built in an honest endeavor to see whether the construction would operate successfully, that as you operated that model the film rose and fell with respect to that part of the surface which is between the pressure rollers: that is to say, at the translation point, and that as a result of this, the sound

track was out of focus. Did you in substance testify to that?

A. I testified that it was a characteristic of that construction that the film did not stay perfectly in focus. I did not say it was out of focus all the time. It varied slightly with reference to the focal point because it rose and fell slightly with reference to the surface of the cylinder.

XQ. 146. But as you operated that machine you testified that it did rise and fall in that model as you ran it.

A. I believe I did. That is a fact, at any rate.

XQ. 147. That is a fact?

A. Yes.

XQ. 148. And that rising and falling of that model would put the sound track out of focus?

A. Slightly. It introduced a slight disturbance and, to correct that, I put on what I call a shoe which held the film down, and then the disturbances which had been due to slight variations of focus, ceased.

XQ. 149. And you described that as a separate imperfection or inoperative feature from the spring drive, didn't you?

A. Yes, that is one which would characterize Figures 3 and 4 as well as Figures 5 and 6.

XQ. 150. And you claim that the flopping, as you call it, up and down on the cylinder at this point occurs as a result of pressing the film on the sprocket wheel by the pressure rollers, by the method of the patent shown in Figure 4?

A. Yes.

XQ. 151. And is it your testimony that it is impossible to build an apparatus with the spring drive of the general character shown in the patent in suit to work satisfactorily and that such a construction is worse than no spring drive? Is that the substance of your testimony?

A. Did you read just what you meant to?

XQ. 152. I thought I did.

A. As I understood you—No. But I don't think you said what you meant to.

XQ. 153. And it is your testimony that it is impossible to build——

A. Impossible?

XQ. 154. Yes.

A. Yes. Well, wait a minute now. Just read that once more.

XQ. 155. And it is your testimony that it is impossible to build an apparatus with the spring drive of the general character shown in the patent in suit to work satisfactorily and that such a construction is worse than no spring drive?

A. No. I wouldn't make any such statement as broad as that, because I don't see how anybody could. What I do say is that the construction as described in the patent does not provide for any means of stopping the oscillations which inevitably tend to occur in such a system; and that in my own endeavor to faithfully embody the construction, the result showed that the machine as so embodied was inoperative.

Q. 156. And that difficulty that you have described is due, as you say, to the fact that they used a weak spring in connection with the flywheel, with the understanding that the spring is so arranged that the arm does not touch the two stops during the normal operation?

A. Well, if you don't use the words "weak spring" in any offensive sense——

XQ. 157. No.

A. —yes. That is, the system as constructed, according to your description, I will understand to mean one having freedom to oscillate if there is nothing to stop it. And that patent does not provide anything to stop it.

XQ. 158. In other words, you maintain that there must be a damped spring or damping means in connection with the flywheel to avoid the oscillations and make it operative?

A. There must be damping of some sort to stop the oscillation.

XQ. 159. Mr. Waterman, regarding the demonstrations that you have testified about which were given Tuesday evening, what was the purpose of the refrigerator in the room we saw in the room where the machines were located?

A. To keep the wax records cool. At the time of the Edison fire the moulds for making the commercial records were destroyed. We applied to the Edison Company to make records for us, and they stated that they would do so, but they would have to make the moulds—and the price was inordinately high. So we used wax records such as are used in the recording room for playbacks, and such as would be used in making the moulds. Those records would have to be gold-plated, and then a very elaborate process gone through to make hard records.

Now, if we had played those wax records in temperatures such as we have had, they would have been destroyed with one or two reproductions—perhaps a single reproduction would have ruined them.

XQ. 160. Those wax records were so soft that you found it advisable to have a refrigerator to keep them in when you are not using them?

A. They are good hard wax. That isn't the point. All wax is soft.

XQ. 161. Why do you keep a refrigerator to keep them in?

A. I have told you: so that we could play them more than once.

XQ. 162. And is that a relatively soft wax?

A. No, it is a relatively hard wax.

XQ. 163. How does it compare with the usual records that were sent out to be played on those machines?

A. Commercial records?

XQ. 164. Yes.

A. It does not compare at all.

XQ. 165. Much softer?

A. Why, of course. Wax records never went on the market; never could go on the market. These are the laboratory records from which the hard celluloid records were made.

XQ. 166. Yes, I understand.

A. But they were always played back in the laboratory, and in order that they might be played back they were always kept cold. We are only following the regular practice.

XQ. 167. Now, what would have happened to those records used by you if a stylus had been used to play them, such as was used in these machines when they were put out and with the same pressure of the stylus on the record as was used on those original machines?

A. I don't know what the question means. But perhaps I can tell you what you want to know. Wax records could never be played back with the stylus adopted for playing a celluloid record. It never has been possible, and I don't suppose it ever will be possible. The wax records are played back with a special playback pickup. That is what we used.

XQ. 168. How were they played in Edison's time when he put those machines out?

A. Why, when I worked in the Edison laboratory years ago, when we played back from a wax record, we used a wax record playback to play with. And when we played with a commercial record we used a commercial stylus to play with.

XQ. 169. So that you have a special stylus arrangement and special stylus pressure where you are

using wax records as distinguished from where you are using a hard rubber record?

A. Always. The same is true of flat records.

XQ. 170. And all of those records that you demonstrated—and by records I mean the cylindrical records that you demonstrated the other evening—with the exception of the old Watson record and the Minstrel record, were of this recording wax type?

A. Yes, because they were the only ones we could get.

XQ. 171. With what pressure did the stylus that you did use on those records in the demonstration bear upon the wax record as you demonstrated it?

A. You mean in grains or grams or what-not?

XQ. 172. Yes.

A. Why, I haven't the slightest idea. It was the very lightest pressure that would make a track.

XQ. 173. Almost perfectly balanced so that it just barely rests on the track?

A. You can't say that; because it rests sufficiently to track. But if we could have made a track with any lighter pressure, I assure you we would have done it.

XQ. 174. In other words, you would have made it as light as possible?

A. Yes, because we have to reproduce those records and they are laboratory wax. If the Edison factory had not burned down we would have done something different.

XQ. 175. And the records that you used in these machines for demonstration were not made on these machines, were they?

A. No.

XQ. 176. They were recorded by the most improved and modern electrical recording system and on a modern machine, were they not?

A. They certainly were.

XQ. 177. Will you describe just briefly how they were recorded electrically?

A. Well, I saw a good many of them recorded; but I do not know that I can describe that apparatus in its detail. In fact, I would not want to know those details. I am not prying into the secrets of peoples' laboratories.

XQ. 178. Well, you do know that it was an electrical system of recording, using ampliers and——

A. Surely. I know. I will give you a general idea: these records were made from a previously recorded disc record by the process known as dubbing. The signal was picked up from this flat disc record, amplified to suitable volume, carried from its place of origin to the recording laboratory, there passed though an electrical recording device, which bore on the smooth wax cylinder with a suitable pressure, and by means of the current this cutting stylus was vibrated, cutting a continuous fine ribbon of wax from the surface of the cylinder, and a suction blower was so located with respect to the cutting point that as this little stream of fine wax—like a lathe cutting—came from the tool, it was sucked away so as not to injure the wax record.

XQ. 179. And by making the records in this manner you got rid of the irregularities or defects which would have occurred if the records had been recorded on the Edison Kinetophone. That is, you——

A. I don't say that. I wouldn't say that at all.

XQ. 180. Well, do you want to say that the Edison Kinetophone made a record in those early days as well as the records that were made by this most modern approved process that you had these made by?

A. No. But the differences were differences in frequency range rather than in anything else. I made records at the Edison Company years ago with the Edison recording apparatus substantially like that in court, and they were good, they were awfully good.

XQ. 181. And the difference in frequency range gives you a truer reproduction of sound, doesn't it?

A. One more comparable with that which is recorded on the film. Therefore more comparable with the sound as reproduced by the alleged infringing machines. My object was to eliminate every difference except that due to speed. And I came just as near it as I could.

XQ. 182. And in your direct testimony you testified that the matter of frequency was one of the factors that was important in reproducing sound faithfully?

A. That is why I eliminated everything else, so that only the frequency as determined by the speeds of the machines should remain to constitute a difference.

XQ. 183. No. Don't let us talk at cross purposes. I am talking about the frequency in tones of speech now, not in the frequency of your machine. Didn't you testify on direct that one of the factors that determined proper sound recording and reproduction was the factor of being able to get the frequencies, the vibrations of the voice or the musical instrument?

A. Yes. And I also testified that that is why I took great pains to see that there were no frequency errors in the records themselves; so that if you heard a frequency error in the reproduction, it was due to the reproducing machine wholly, not due to the record.

XQ. 184. Then will you agree with me that these records that you had for demonstration were as perfect as you could get them with respect to the recordation of the sound you wanted to produce?

A. From the point of view of constancy of speed, I certainly do. We made the utmost effort to have no speed variations whatever in the record.

XQ. 185. Now, Mr. Waterman, isn't there something besides constancy of speed involved in the question I am putting to you?

A. Not a thing so far as this case is concerned.

XQ. 186. Will you please let the case alone and just answer my question, giving the plain English interpretation to the word?

A. I thought I did. But I beg your pardon if I didn't.

XQ. 187. I am trying to get your mind focussed on the factor of frequency of the sound vibrations in the air. Do you understand that now?

A. That is what I understood and that is why I confined my answer to it.

XQ. 188. All right. Now, in the system you used, was not that system more sensitive to frequency vibrations of the air than the old system used by Edison?

A. When?

XQ. 189. Used by Edison when these early machines were put out.

A. You haven't made your question clear.

XQ. 190. You testified about a certain system you used in recording these wax records, haven't you?

A. Yes.

XQ. 191. And you are familiar with the system used by Edison in recording his records when those machines were put out?

A. Yes.

XQ. 192. Now I ask you if the system you used in recording these demonstration records was not more sensitive and perfect with respect to getting the true frequency of the air vibrations due to sound recorded on that record? Assuming the same speed in each case, if you want to.

A. The question doesn't make sense to me. If you mean that the speed of the machine during recording was just as constant as I could possibly get it, you are quite right: it was. Therefore, the frequencies recorded were probably as accurately recorded as they ever have been in history.

XQ. 193. Will you assume that the old Edison machine ran at the same constancy of speed as the machine that you used for recording these records: take this assumption. Now, I ask you if, under that assumption, if the system that you used—the amplification and whatever your system was that you described—for making these present records was not more sensitive to sound vibrations than the old Edison system, so that you got a truer detail of the sound tone—take up the audible frequencies that we meet with in sound reproduction.

A. You mean so that it could make a deeper groove or something of that kind? I would say no.

XQ. 194. No what?

A. It was not more sensitive. You don't want a groove deeper than a certain amount anyway. We cut a deep enough groove with the mechanism of the early Edison machine, and we cut as deep a groove as we wanted here.

XQ. 195. Don't you understand what I am getting at?

A. I certainly do not. I can't make out at all what you are trying to get at.

XQ. 196. Does the new system that you used for recording have a wider frequency range?

A. Oh, I told you that. Yes, certainly. It probably had quite a little wider frequency range; because it is important that we should have as wide a frequency range on our records as on our film, in order that there might be nothing to distract the attention except the question of the speed of the machine. Those records are alike; I made them just as near alike as I could.

XQ. 197. Then all that the demonstration that you gave was intended to show was that if you took one of these old Edison machines and put a perfect record on it, made by modern methods and reproduced by modern

methods, that it would indicate the constancy of the rotation of the mandrel on which the record was placed?

A. I think that is correct. Let me state it, I meant to give the Edison machine the benefit of the same constancy of record with respect to speed that I gave the alleged infringing machines, so that the Court might judge without having to make any allowances, whether the speed of the Edison machines was or was not as constant as the speed of the alleged infringing machines. And I can't yet think of any other way by which I could have done it.

XQ. 198. Was any feed screw used on the Kinetophone, the Edison Kinetophone, in the demonstration that you gave with the moving stylus?

A. No.

XQ. 199. You used, instead of the traveling stylus being propelled along a screw thread, as the Edison Kinetophone was equipped to do, instead of using that you used a long lever, delicately pivoted well back, so that the lever on its pivot could swing back and forth along the sound cylinder record and follow the groove; is that right?

A. Yes and no. In so far as it implies that I used something special, it is wrong. I simply took the regular laboratory playback, such as they have for the same purpose. If you mean that it was a long lever whose pivot was far enough away from the cylinder so that inaccuracies due to change of angle would not introduce complications, then you are right.

XQ. 200. And you say you used the same long lever and stylus that they used: you do not mean that they used when these machines were put out. You mean that they used in making these records for you at this time?

A. That they used in playing them back. I had a record, then I had it put in the refrigerator and chilled;

then I had it taken to a reproducing machine,—not these here, but ones that they had—and they played it back for me. And in playing it back they used their standard laboratory wax record playbacks.

XQ. 201. And what is it called? It is known in the trade by a certain name, isn't it?

A. If it is I don't know it.

XQ. 202. Who is the manufacturer of it? You don't know who put it out?

A. Oh, it is put out—I suppose it is made by the Bell Telephone Laboratories. I don't know.

XQ. 203. It is nothing that existed back at the time that these defendants' machines were in commerce?

A. No, I don't say it was. Electrical pickups did not exist at all at that time.

XQ. 204. And this particular type that you have used here has only existed in the last two or three years?

A. That may be so. I told them I wanted the best.

XQ. 205. Now, with respect to the Edison Triumph machine, the same thing holds true, as you have testified with regard to the other Edison machine, with regard to the record, the character of the cylinder, pickup and so forth?

A. Quite right.

XQ. 206. And the same is true as to the Constable machine you demonstrated?

A. It is.

XQ. 207. Now, with regard to the stylus film type of machines using a stylus record point and a reproducing from a record on a strip of film, and taking the Dragoumis machine as an example, did you have that record that you demonstrated in the Dragmouis machine recorded on a modern machine by electrical recording methods involving amplifiers, and so forth?

A. No and yes. It was not done on any regular recording machine, but on a machine which was extemporized. It was done by modern electrical methods, of course.

XQ. 208. Using amplification and so forth?

A. Of course.

XQ. 209. And what do you mean by that it was not done on a regular machine but on one that was extemporized or temporarily devised? What do you mean by that?

A. I mean just that.

XQ. 210. Well, did you get those records that you have on that thin motion picture film produced on machines that are put out in the market today?

A. I did not.

XQ. 211. So you had to get up a special machine to cut those records?

A. I did not get up any special machine. There was nothing to it at all. Simply rigged a shaft and mandrel to turn at uniform speed by putting on a big enough flywheel. That is all there was to it. Then we put over it a machine, one essentially like an electrical pickup type, and I did that, and I think that particular one is made with a sapphire point, and just let it run over the record to push a groove in it.

XQ. 212. And that pickup is a recent development, isn't it?

A. I don't know how recent. I have had one for a great many years; but whether it was just like that I don't know.

XQ. 213. Does the Dragoumis record of the Dragoumis patent show a hill-and-dale record or lateral record?

A. I should say it was probably hill-and-dale.

XQ. 214. And what was the kind that you used on this celluloid film that you ran through the Dragoumis machine.

A. A Lateral record.

XQ. 215. Now, with respect to the Edison Skeleton machine: is your testimony given with regard to the Dragoumis machine the same, as to the manner in which you made the record run through the Edison Skeleton machine?

A. I am not perfectly sure about that. We did have a machine in one laboratory that was made many years ago for just this purpose. Some of our records were made on that machine. The one on the Dragoumis was not. That I know. I am not sure whether the one that was one on the Edison Skeleton was made on the same machine that made the Dragoumis record, or whether it was made on this old actual machine.

XQ. 216. With respect to the stylus reproduction records on film such as you used on the Dragoumis model, you have repeatedly testified that these sound records were "rubbed in" the celluloid. Why do you refer to that as being rubbed in?

A. As distinguished from cut in. The original Edison method was the indenting process. Later records were cut. This process was an indenting process.

XQ. 217. The process you used in these records you demonstrated was what?

A. Indenting process.

XQ. 218. Were they not cut also?

A. No. None of the mechanically made records on film were cut. Those on wax were cut.

THE COURT: We will take a ten-minute intermission at this point.

(After a short recess the witness resumed the stand.)

XQ. 219. With regard to the records that you demonstrated of the Dragoumis model, did you cut the records on both surfaces of the Dragoumis record, as specified in his patent?

A. The record was not cut at all.

XQ. 220. Indented?

A. It was only on one side. The patent does not require that it should be on both sides. It says it may be on both sides.

XQ. 221. And with regard to the Bell & Tainter patent, did that describe a lateral cut record instead of a hill-and-dale record, or does the patent describe a hill-and-dale record?

A. If you will pardon me for a moment, I will have to look that up. (Referring): Without reading the specification, I should judge from the drawing it was a hill-and-dale.

XQ. 222. And in the record you used on the Bell & Tainter it was a later record?

A. I think it was, yes. I don't know that I ought to quite agree to the form of your question. You mean the one that I intended to use?

XQ. 223. Yes. And with regard to the motors for driving the different models that you demonstrated, will you please state the type of motor that was used for driving the Edison Kinetophone?

A. I don't believe I remember.

XQ. 224. Was it an electric motor?

A. Yes, an electric motor. Whether it was the original or not, I don't know.

XQ. 225. Was it the one on the model that was produced here, or wasn't it the one on the model as it was produced?

A. There was no change made between.

XQ. 226. And on the Edison Triumph, did you use the spring motor or an electric motor?

A. The original spring motor. That is to say, the spring motor that was in it when it was produced. That I believe was not the one on it originally. It was the one that was not the one on it when it was obtained,

but it is the one that Mr. Webber substituted because of a broken spring in the original.

XQ. 227. And in the Constable model, what motor did you use?

A. Regular old-fashioned dictating machine motor.

XQ. 228. Electric motor?

A. Yes.

XQ. 229. Direct or alternating current?

A. Wait a minute. The Constable model? That was a regular spring motor.

XQ. 230. The Constable model?

A. The Constable model. The Dragoumis I think it was that was driven by the ordinary Dictaphone motor, as I remember rightly.

XQ. 231. And the Edison Skeleton machine was driven by what kind of a motor?

A. I don't remember.

XQ. 232. And the Reel Film machine was driven by what kind of a motor?

A. I don't remember that, either. Ordinary little motor.

XQ. 233. Constant speed motor?

A. I don't remember whether that was a synchronous motor or not. I will have to look it up.

XQ. 234. And the General Phonograph machine that you referred to?

A. A small direct current motor, as I remember; nothing special about any of them.

XQ. 235. And do you remember whether this General Phonograph motor had an oil damped pickup on the machine? Not the motor.

A. Yes. I believe we did not have enough of the other pickups to go around. I think it was on one of them, and I think it was on that one that we used an oil damper.

XQ. 236. Was that a Western Electric type?

A. I think that was the one on which we used—I think we used the Western Electric pickup on the General Phonograph Machine and on the Victrola.

XQ. 237. You testified that aside from the fact that you did not use paraffin paper in the Bell & Tainter model as called for by the patent, that in making the model you followed substantially the model in the Smithsonian Institute. Do you know what that model in the Smithsonian Institute looks like?

A. Yes, I can show you a photograph of it.

XQ. 238. I show you two photographs and ask you if you know what they are?

A. Yes, they look like the model at Washington.

(Photographs shown witness Waterman on cross-examination of model of Bell & Tainter machine in Smithsonian Institution, marked Plaintiffs' Exhibits 41 and 42 for Identification.)

XQ. 239. Did you ever see that machine?

A. No, I did not go down to see it. I had someone go down and obtain official photographs of it.

XQ. 240. You gave a demonstration with the Hoxie machine, but you only demonstrated it with a speech record. Did you hear Mr. Hoxie state that he or the General Electric Company also had the musical records that were available?

A. No, I did not hear that. To tell the truth, I did not have anything to do with that demonstration.

XQ. 241. Was a musical record tried on that machine?

A. Not to my knowledge.

XQ. 242. With regard to the photoelectric cell situation, do you know of any type of light-sensitive cell that has a separate anode and cathode with an open space between them, which cell is not a photoelectric cell?

A. Well, there are cells where the space between is filled with liquid, but if by "open space," you mean empty, the answer is no.

XQ. 243. Isn't it a fact that the Figures 3 and the other figures of the patent in suit clearly show a photoelectric cell?

A. I don't know what anyone would have interpreted that to mean at that date.

XQ. 244. At what date?

A. I believe the date is March something, 1921.

XQ. 245. And is your reference to "that date", your qualification by the words "of that date" is due to the fact that the PE cell was so little known at that date?

A. Well, the photoelectric cell had been well known in scientific circles for a great many years. I don't know that it had taken a standard form. I don't know whether it had or not. The Kunz cell was one that I knew back at that time, and that of course is a little different shape.

XQ. 246. And looking at Figure 3, p illustrates the anode and 1 indicates a deposit on the glass?

A. The specification says that p indicates the anode and 1 a cathode.

XQ. 247. It is so described, isn't it, in the patent?

A. Yes, sir; looking at the original specification.

XQ. 248. And there is not any doubt as to what this patent shows and describes, that it shows a photoelectric cell, doesn't it?

A. Oh, I would take it for that now, of course.

XQ. 249. You referred to Figure 2 of the first German patent as illustrating a construction in which the film was held taut at the translation point. Isn't it a fact that for the film to be thus held taut, there must be some slippage between the film and one of

the pair of pinch rollers as the film passes between the two?

A. Yes.

XQ. 250. You testified that a belt is a much more effective and suitable device as a drive for film in a sound head, if one is going to use a resilient drive at all. Perhaps you can tell us why defendant uses a spring drive rather than a belt?

A. Well, I am not in the confidence of the defendant to that extent, but I think there is no doubt about the fact—because they don't want to bother with a perforated belt and a non-perforated belt might slip.

XQ. 251. In connection with your experiments in the building of a model of the old German patent, did you not try a belt drive for the shaft, or one of them?

A. No. I never tried any model except the one that you saw.

XQ. 252. And when was that model built?

A. I could not, without looking up the record, tell you exactly, but when Dr. Engl was testifying, he stated, to my great surprise, that he regarded the arrangement shown in the German patent as inoperative.

XQ. 253. You know the model was then built since we have come to Scranton here?

A. Oh, yes, it was built within the next twenty-four hours.

XQ. 254. Hasn't that model got a marking on it, 3/27/33?

A. On what part of it?

XQ. 255. On the top of the frame next to where the film runs.

A. Yes. I told you that is the same frame that was built last winter for the model Figures 5 and 6. At that time we also built a model Figure 1, and we used the parts of that model of Figure 1 of the patent in suit, plus such other parts as had to be made to make that model of the German Patent No. 387,058. I

started two men off on the midnight train that night to a machine shop in New York, and they came back, leaving New York the next night at midnight, arriving at Scranton the following morning, and the model is in the condition as they brought it. Of course, it is crude. It is fragmentary and has to be taken apart and put together to get it into that frame, but we did the best we could in the time. I thought it might come up that next day.

XQ. 256. You further refer to the first German patent and you testified at record page 1356 as follows: "So what the patentee says is that that gate may be placed either on one side or the other of the roller, which is to say that it may be driven either from its bottom or its top end, as shown in Figure 1."

The roller that you are there referring to is what the patent refers to as the pair of rollers, one of which carries the flywheel; is it not?

A. Yes.

XQ. 257. And they do not drive the film, do they? The film drives the roller in that German patent, doesn't it?

A. Did I say that? I apologize. You are quite right. It does not. The film drives the roller. The patent expressly says, as I pointed in connection with the same testimony you are quoting, that the film is driven by—I think the language is—"one roller."

XQ. 258. It is "a roller," isn't it?

A. Not in my translation. My translation reads: "The guide bars ll hold the film, which is driven by one roller, not shown in the drawing, exactly in the focal line, or the guide bars are provided with a narrow slit." Then it says "After this guiding the film passes two rollers r_1, r_2, resting under pressure against each other, one of which is connected with the

centrifugal mass m." That is what I intended to testify to. If I slipped, I am sorry.

XQ. 259. Then in regard to your quotation in one of the questions just ahead, you follow that up by stating that in view of that statement the patent teaches that the film may be driven either from the bottom or the top of the gate as shown in Figure 1. That does not follow any longer, does it?

A. Yes, absolutely.

XQ. 260. The pair of rollers that the patentee says may be above or below the gate, you say do not drive the film.

A. I see what you mean. That is my way of illustrating it. If I put the one roller for a drive at the bottom in Figure 1 of No. 387,058 German patent, then the gate ll is between this driving roller and the pair of rollers r_1, r_2, and if on the other hand I put it at the top, then the alternative construction exists in which the rollers r_1, r_2, are between the driving point and the gate. I might have stated the same thing by stating that the patent says that ll may be either below or above r_1, r_2.

XQ. 261. I think we are at cross purposes. Your statement on the record was that since the patentee stated that the pair of rollers r_1 and r_2 may be above or below the gate, that the patent taught that the film could be driven from above or below the gate. These rollers r_1 and r_2 do not drive the film; they are driven by the film, are they not?

A. I never intended to intimate anything to the contrary, and the statement you are now referring to certainly does not say that. I am sorry if I misled you. I merely meant that the relations between ll and r_1 and r_2 would be seen in one alternative if you imagine the not-shown roller at the bottom, and it would be seen in the other alternative if you imagine

the driving roller at the top. That is all I meant. And that is perfectly clear, I think.

XQ. 262. But the only thing that the patent refers to as being above or below, is the roller r_1, r_2. That is the only roller?

A. With reference to the gate?

XQ. 263. Yes.

A. Yes. In other words, what the patent says is that the roller which pulls the film may be so positioned that the film passes first between r_1, r_2, then through ll and then around the propelling roll, or the film may pass first through the gate, then through the rollers r_1 and r_2, and then around the propelling roll.

XQ. 264. That is just where I don't agree with you. As I read the patent it states that the rollers r_1, r_2 may be above or below the gate. That is correct, isn't it?

A. Yes, which would bring it——

XQ. 265. Just one minute. Is that much correct?

A. Well, I don't see anything wrong with that.

XQ. 266. All right. Now, the patent with regard to the roller that pulls the film merely says that the film may be driven by a roller not shown. That is all it says, isn't it?

A. Yes.

XQ. 267. You referred to that part of the specification of the patent in suit which had reference to preliminary winding up; and I think instead of referring to the patent in suit you referred to the original specification; and according to my copy, you gave the wrong page number; according to the certified copy I have, the correct page number of that original specification is page 6. Have you got the place?

A. Yes. I have the place. But on my copy it is on page 7.

XQ. 268. The certified copy gives page 6, doesn't it, that I hold in my hand?

A. No. It gives page 7.

XQ. 269. You have 7 of the file reference, Mr. Waterman. I am talking about page 6 of the original specification in this respect.

A. Well, we agree.

XQ. 270. Mr. Waterman, you stated that you interpreted the terms "preliminary winding up" to mean "preliminary to winding up," didn't you?

A. Yes.

XQ. 271. Now I want to read you the entire sentence: "The free ends g-g of the film band are preferably guided by the rollers for preliminary winding up in the manner well known in cinematography, so that they form a loop." In that sentence, if you take your interpretation of the words "preliminary winding up," can it make sense? That is, if you insert the word "to" between "preliminary" and "winding up."

A. No; you have to leave out "for."

XQ. 272. You have to leave out "for"?

A. Yes. I took it that "for preliminary winding up" was a clerical error for "preliminary to winding up."

XQ. 273. Isn't it a more natural interpretation of the whole sentence to say that "preferably guided by the rollers for preliminary threading up"? You know what that means, don't you? You don't have to insert anything there, do you?

A. That doesn't mean anything to me on the machine shown.

XQ. 274. The threading up of a motion picture machine does not mean anything to you?

A. I didn't say that at all. Of course, I didn't mean that. I mean that as you try to interpret that passage there is not in the drawing anything to indicate the operation. Now, I take the passage to mean that pull down and hold back sprockets, which are not shown, are to be added in the manner well known

in motion picture machines, for the purpose of providing Figure 4 with a loop on each side of the cylinder d. In other words, so that the takeup and supply rolls won't be jerking the film as it is passing the translation point.

XQ. 275. Did you intend to testify that the idea of the use of the apparatus of this patent in a motion picture machine was contrary to the disclosure of the patent?

A. No.

XQ. 276. As I understood your testimony yesterday with regard to the first German patent, you stated that it referred to two kinds of speed, the constant speed and the regulable or average speed, and you stated that the regulable average speed was the speed that was taken care of by the speed governors?

A. I said that was one function of the speed governor.

XQ. 277. But there were two different kinds of speed provided for in the patent or the patent attempted to provide for?

A. No. I didn't say there were two kinds of speeds provided for. I said the matter of speed regulation is viewed in its two aspects, we must have, if we are going to get a true pitch, we must have about the correct number of revolutions per minute or second. If we are going to avoid wows, we must have the motion through each revolution sensibly uniform—uniform enough so that the disturbances which occur will not be objectionable for the purpose at hand.

XQ. 278. What kind of speed is referred to by the regulable average speed?

A. A certain number of revolutions per minute.

XQ. 279. Is that taken care of by the flywheel or by the governor?

A. By the governor.

XQ. 280. Will you please state what is the closest of the prior art patents that you referred to, in your opinion, with respect to the structure of Figure 1 of the patent in suit?

A. Figure 1. Well, if you mean like Figure 1 in its characteristic of having two flywheels and two cylinders and a light gate between, the arrangement being such that the film has a uniform speed while approaching the light gate and while receding from the light gate, I think the German Patent 387,058 is the only one that is very much like that.

XQ. 281. Now with the assumption that as the specification says that he would only have one flywheel, which prior patent is the closest to it?

A. I never have known just what that meant. It is a little obscure and ambiguous.

XQ. 282. Taking either of the constructions of Figure 1, Mr. Waterman, and disregarding the German patent—which I contend not prior art—what is the nearest of the other patents to that structure?

Mr. Neave: Your Honor, it seems to me that this last question is a waste of time, because neither you nor I nor Mr. Waterman can know just what Mr. Ward means by what he says, as to whether the prior patent has to have in it everything that is there or the principles of what is there. The thing is a matter of argument and study from the facts. This witness may think that one prior patent is more like Figure 1, and I may think another prior patent, or you may think another prior patent is more like Figure 1, because each of us is translating in his own mind what we regard to be the essentials of Figure 1.

As we have the facts before us, I don't know what the testimony along this line does; it doesn't do any good to either of us, in my opinion. I have

no objection to the witness doing the best he can and answering the question; but we won't get anywhere.

Mr. Ward: Your Honor, I think that these last questions are the most useful of any line of questions that has been put. Having all this mass of patents referred to, I think it would be well for the Court to know as to what these expert witnesses who have testified about these patents consider as to which patent or patents they think are the closest to each of the patents in suit.

The Court: I suppose it is competent testimony.

A. Well, it is very difficult to know what you mean by that question, Mr. Ward.

XQ. 280. Mr. Waterman, you have described the patents. You know what are the prior patents, you know what they show. Now, you have given your opinion about what they show. And you know what the structure of Figure 1 of the patent in suit is. I ask what in your opinion is the nearest patent to the structure of Figure 1 of the patent in suit.

A. Well, your question says Figure 1 in either of its constructions.

XQ. 281. Take them separately if you want to.

A. Well, Figure 1 is only one construction.

XQ. 282. Take that one.

A. The figure does not agree with the description. And the description says that it may be constructed differently from what is shown in another respect. Now, I don't think it is possible to compare indefinite things. The Figure 1 is quite like the German patent, as I have told you.

Mr. Ward: I object to that, your Honor.

A. (Continuing.) There is a close analogy. There is not a close structural analogy between Figure 1

in its organization as shown and any structure of the other prior patents. Figure 1 is characterized by having a light gate between two rollers, which rollers are geared or belted together, and one or both provided with a flywheel, as near as I can make out. I don't know of anything in the other prior patents that in its specific construction has those details.

XQ. 283. Now, with respect to Figure 2 of the patent in suit, which of the prior art patents in your opinion is the nearest to that structure, eliminating the German patent?

A. Well, again, I don't know how much you want to go into details of construction.

> THE COURT: I do not think it requires going into detail much, in that. I think that question can be answered without going into a long detail. At least, it would appear so to me. It is a perfectly plain question and I think it can be answered, because the witness is an expert and has shown that.
>
> What the Court wants is not a sort of sparring between counsel and witnesses; we want the facts, the proof.

A. (Continued.) Well, I will assume that your question asks me what patents in the prior art show a cylinder associated with a flywheel so that its speed is governed thereby, and having a film passed over that cylinder and having the translation occurring on the cylinder.

XQ. 284. No. I asked you which of the prior art patents was the nearest to the structure shown in Figure 2. It is a very definite structure.

A. All right. I have defined what I understand you mean by the structure of Figure 2. And, so understanding, I think that one might refer to either Bell & Tainter Patent 341,214, the British patent to Peder-

sen, 115,942, of 1918, United States patents to Cawley, 1,825,438 and 1,878,577; French patent to Dragoumis 472,467, all as complying with what I understand your question to mean in all matters of substance.

XQ. 285. Among those you have no choice as to which is the closest?

A. No. Because I am not able to further refine the meaning of your question.

XQ. 286. Will you please answer the same question as to the construction of Figures 3 and 4 of the patent?

A. I think the same list goes. I think this is very inadequate and unfair presentation of the art, because from my point of view there is no difference as to whether the record is on film or whether on a cylinder or on a disc, as to uniform speed. But I will let the same answer stand, perhaps adding Gally 210,249 and Trowbridge 1,447,913.

XQ. 287. And have you any preference among that list you have mentioned as to which is the nearest with respect to Figures 3 and 4?

A. No. If I was going to choose, I might choose Cawley. But I don't think there is a great difference.

XQ. 288. And what is your answer as to the same question with respect to Figures 5 and 6?

A. Well, the Gally patent of course has exactly the same sort of a drive. Such drives were old for all sorts of purposes. Royce, British Patent, 15,333, of 1912, is a good example. Patents like Holst, that have belts, and Amet, that has another form of resilient drive, and Constable, all contain any additional disclosure that is found in Figures 5 and 6. So that it didn't leave anything to be done, in my judgment.

XQ. 289. You understand that Figures 5 and 6 show something other than a spring between an arm and a flywheel, do you not?

A. Well, Figures 5 and 6 are Figures 3 and 4 plus the arm and the spring, and I am taking that my answers with respect to Figures 3 and 4 go with these additions.

XQ. 290. So that your answer to the question with respect to Figures 5 and 6 include the patents that you mentioned with respect to Figures 3 and 4 plus these additional patents?

A. Yes.

XQ. 291. Now, will you please answer the same question with regard to the defendants' construction PS-1?

A. PS-1 contains the flywheel-spring arrangement with damping means very closely similar to that of the Royce Patent 15,333 of 1912. It is a damped arrangement, of which there are legions in the art. It is not necessary to mention a lot of them.

XQ. 292. And that is all the structure that PS-1 shows, a damping arrangement between a flywheel and a sprocket shaft or a drive for the flywheel?

A. Well, Figure 1—do you mean in all its details?

XQ. 293. No.

A. Well, I will answer: PS-1 is a combination of a motion picture head and a sound head with all the mechanism pertaining thereto. The sound head is exactly like the motion picture head, except that the intermitten movement in the motion picture head has been left out and the flywheel applied to the continuously moving sprocket near the sound gate. The flywheel has the well-known spring drive of the art, plus a damping means, which is essential to its operativeness. Why, a very excellent illustration of such a drive is way back in the early British patent to Jamieson, where the damping, instead of being applied by a pad of felt is applied by a disc and a magnet. That patent to Jamieson is 2814 of 1884. Such damping systems to prevent

oscillation are very old and very well known. PS-1 simply applies common sense to the application of a drive such as is old in the art.

MR. WARD: Your Honor, I object to this argument. He has not answered my question yet.

THE WITNESS: I apologize if I haven't. I think I have.

MR. WARD: When you get through your argument, Mr. Waterman, for the defendants, will you please state which patent or patents, in your opinion, are the nearest to PS-1 structure?

THE WITNESS: Well, I told you, with respect to the particular identifying characteristics of that structure, I think the Royce British Patent is as close.

XQ. 294. The Royce British patent?

A. Royce.

XQ. 295. Royce, and what is the other one?

A. I also referred to the old Jamieson patent.

XQ. 296. And those two patents, in your opinion, are the closest art to the PS-1 structure?

A. In the respect of the feature which makes it operative, namely, the damping.

XQ. 297. I did not ask you about any particular feature. I asked you for the nearest patents to the structure shown in that machine. Take the Figure 1 and Figure 8, which illustrates in substance the structure. Now, have you named the two nearest patents to that?

A. Well, do I understand that you want a patent showing a talking motion picture machine having all the capabilities of PS-1?

XQ. 298. Do you understand what is shown on the chart, Figure 1?

A. I do.

XQ. 299. Do you understand what is shown in the Figure 8?

A. I do.

XQ. 300. I ask you what is the nearest prior art patent to the structure shown in those two figures.

MR. NEAVE: You are including the picture projection part, are you, Mr. Ward?

MR. WARD: I am including just what is shown on those two figures that I have directed his attention to. And I do not want to attempt to interpret the figure for him, because we will never get through.

THE COURT: I may be wrong, but I think that is a fair question put to an expert who is so familiar with all this invention.

A. Well, I can only define what I understand. If you want——

MR. WARD: You Honor, I think if he will just mention the patents and not go into any detail about the figures and some more argument, we will get through much quicker.

I am only asking him for the numbers of the patents. If your Honor wants to hear him, I will withdraw my objection.

THE WITNESS: I have only two ways of answering.

THE COURT: I want to be fair to the witness too. We know that it is sometimes difficult to answer without definitions. When you compare one thing with another you have got to know the meaning of the things that you compare. I don't want to be understood to criticise too readily either lawyer or witness.

If that is a fair question and you can answer it, why, I will be glad to have your answer.

THE WITNESS: Why, I am very anxious to assist your Honor, and if I thought the question was definite I would answer directly.

THE COURT: I say, I want witnesses and lawyers here to understand my feeling that here are technical problems and scientific questions that require a lot of knowledge and background, and I think the Court ought to be very slow to criticise either lawyer or witness. And I want you to understand that this is my disposition.

But on the other hand, I would like all witnesses to be as frank and helpful as possible without evasion or a desire merely to argue, but with the desire to state facts that will assist the Court.

Now, that is the desire of the Court and I do not want it understood that I am criticising any witness, because I might be wrong. But let us do the best we can. All right.

THE WITNESS: Well, I can only indicate to your Honor what I understand the question may mean by the patents I cite, unless I go ahead and state my understanding.

THE COURT: Now, read the question, Mr. Reporter, again, so we thoroughly understand at least what the words of the question are.

THE WITNESS: Yes.

(Pending question repeated.)

(Figures 1 and 8 indicated to the witness.)

A. Those two figures are fragmentary drawings of two machines. I propose to disregard that and go to what I consider substance. And I therefore recite Gally, 210,249; Holst, 587,527; Constable, 1,425,177; Cawley, 1,825,438; Cawley, 1,878,577; Pedersen, 115,942—British of 1918.

XQ. 301. Now, Mr. Waterman, will you kindly answer the same question with respect to PS-16 structure as shown in Figure 1 of the Exhibit 15-D and Figure 8 of Exhibit 16-F?

A. Pardon me; I didn't get the first number, the first figure number.

XQ. 302. Figure 1′ it should be, and 8′.

A. Again, the two figures referred to are fragmentary views of two machines. I would cite as coming as nearly as illustrative as I can understand, the following—in answering each of these questions, I am assuming that the German Patent No. 387,058 is to be omitted.

The Gally Patent No. 201,249; Holst, 507,527; Trowbridge, 1,447,913; Cawley, 1,825,438 and 1,878,577. British patent to Pedersen, 115,942 of 1918. Dragoumis, 472,467, the French patent.

May I request that if I failed to mention it in the last answer, Royce Patent No. 115,333 of 1912 be added, please?

XQ. 303. Now, Mr. Waterman, in your discussion of the Duddell British Patent No. 24,546 of 1912, where you were pointing out to the Court the optical system shown and described in that patent, you referred to the specification, but you did not read to the Court the following from the complete specification starting with page 3, line 33:

> "The diaphragm d, having a rectangular aperture, is so chosen that the length of this line of light is at least equal to the width of the record it is required to produce."

That diaphragm d with the rectangular opening is what is known as a mechanical slit, isn't it?

A. No, that is an optical slit.

XQ. 304. Did I say d, Mr. Waterman?

A. Yes.

XQ. 305. I meant d'.

A. The quotation which you read refers to the d. I think you meant to read line 38, perhaps.

XQ. 306. Yes. That d' is the mechanical slit next to the film, isn't it?

A. Yes, that is optional.

XQ. 307. Did you have in your possession the model of the Clark machine, or the machine with the Clark improvements on it?

A. Yes, it may be here. It may be in court; I don't know.

XQ. 308. That machine was not demonstrated, was it?

A. We have not even tried to use it. That is a borrowed model. We had not any right to play with it.

AFTERNOON SESSION.

Rebuttal.

1:30 P. M.

WILLIAM C. BALLARD, JR., having been previously duly sworn, was recalled as a witness in behalf of the plaintiffs, in rebuttal, and further testified as follows:

DIRECT EXAMINATION.

By MR. WARD:

Q. 584. Professor, you heard the demonstration given by the defendants the other evening?

A. I did.

Q. 585. Will you please state your opinion of the performance of those different machines and, in each case, referring to the exhibits by the numerals indicated on the defendants' program, and the type of machine.

A. Defendants' No. 1, labelled "The Watson Record," was very indistinct. The record showed signs of having been very badly worn, and the volume of sound was limited so that it could not have been applicable for reproduction in any but a very small room.

Q. 586. What was its quality?

A. The quality was of the average for phonographs of the date in which this machine was used. It was very poor, of course, compared to modern standards. Barely understandable in many places.

Q. 587. Go ahead to the next.

A. Test No. 2, "The Minstrel Record," was of the same quality of reproduction; that is, it was quite evident that the high frequency components of the sound and the low frequency components of the sound were not present on the record. The type of the record

being one in which the action moved rather rapidly, there were no long sustained tones, and it was somewhat difficult to judge what was taking place, as far as speed variations was concerned. There were one or two places in which a musical tone was sustained, and this showed very definitely a distinct flutter or periodic speed variation in the machine.

Q. 588. Now, will you go to Part 2, Item No. 3, and so forth?

A. Items Nos. 3 and 4 were comparative tests of the Defendants' PS-1 machine, using film in the first case and disc in the second. Since both of these tests were on speech, it was difficult, if not impossible, to determine anything in regard to the speed variations of the film and disc. Speech, as your Honor noted, is relatively insensitive to speed variations one way or the other.

Test No. 5, labelled as the Edison Kinetophone large cylinder, speech, was of fair quality, as was Test No. 6, the Edison Triumph small cylinder speech. The latter test, that is Test 6, was somewhat noisy and overloaded.

Q. 589. Did either of these tests show anything with regard to the quality of uniformity of rotation?

A. As far as I could determine, there was no difference as far as the uniformity of rotation is concerned, since a wide variation may exist in speech and not be noticeable. That is, your Honor will understand that if the record is speech, the speaker may be reproduced as speaking in a higher pitch of voice and, since that is quite a common occurrence—I may drop my voice at one word and raise it at another word, and that is not noticeable if the phonograph does it for me instead of my doing it personally.

Q. 590. Your statement in that connection is limited to speech rather than to sustained tones?

A. To speech alone.

Q. 591. Now, will you go to the next item, No. 7 and so forth.

A. Items 7, 8, 9 and 10 were of a musical composition entitled "A Waltz." This record had very rapid music, that is, there were no sustained tones produced in this record by which any speed fluctuations could be determined and, as far as this rapid type of music was concerned, it resembled much the previous test, that is No. 6, in that it did not indicate to any very large extent the speed variations. By listening carefully, however, it was possible to detect speed fluctuations in both Tests 9 and 10.

Q. 592. Now, will you go to the next group, starting with 11.

A. Tests 11 to 14 inclusive were of a piano record. A piano record is much more susceptible to the effects of speed fluctuation, particularly if the selection is played slowly and the tones are sustained and held. This record was not particularly good in that respect because it was a very rapid tempo, that is, the notes followed each other rapidly and, with the exception of one or two instances, there were no sustained tones in this piano record. However, it was possible to detect a distinct flutter or periodic variation in pitch in both Tests 11 and 12, and this variation in pitch on Test 13 had become considerably more pronounced, so that some of the notes were, as we say, sour, which indicates that the speed was not maintained constantly.

For some reason which I do not know the Test 14 was apparently a little better than Test 13, in that the notes, the sustained notes of the piano were not as sour as they were in Test 13.

Q. 593. Thirteen and 14 being respectively the Edison Kinetophone and the Edison Triumph?

A. Yes, the two Edison machines.

Q. 594. Now will you go on with No. 15 and so forth.

A. Tests 15 to 18 were made by means of a sustained tone of approximately 512 cycles. As was very easily noticed, sustained tones show up speed fluctuations on the record very, very much more readily than the other types of records, and are commonly used to test constancy of speed of recording and reproducing equipment. There was a distinct slow pulsation in Test 15, that is, the PS1, using the film record.

Test 16, to my ear, was better, indicating that that pulsation was somewhat less noticeable.

The Edison Kinetophone, Test 17, and the Edison Triumph machine, both had very distinct periodic pulsations in them. I should judge, without having investigated very closely, that the two records were off center, as is very often the case in cylinder records. It may have been something else, however, and it is difficult to accurately state what the trouble may be.

Q. 595. Did you mention 18-A?

A. Test 18-A was a test of speech on what I understood to be a special lightweight small cylinder record. Being a test of speech alone it was difficult, if not impossible, to determine anything with regard to speed fluctuations.

Q. 596. You would have had a chance to get some comparison if that had also been of a tone pitch like the others?

A. Yes, of course it would have been if a sustained pitch tone had been recorded and reproduced.

Q. 597. Now will you please proceed with Items 19 and so forth.

A. Items 19 and 20 were similar records of speech. The first, that is Item 19, being reproduced on the Defendants' PS16 machine, and the second on the alleged earlier flywheel patent model No. 387,058, according to the German invention.

Since both of these records were speech, it was somewhat difficult to compare them directly and, if my memory serves me right, the German record was apparently reproduced at a slightly slower rate than the PS16. There was not much chance to check between the two, as far as constancy of speed is concerned.

Q. 598. Please go ahead with the 21.

A. The 21 and 22 records, being of the same musical waltz composition, were difficult to judge. It was quite noticeable that in the Test 22, that many of the high frequencies—components of the fine line that should have been reproduced—were missing for some reason or other; whether it was a question of the film being out of focus or something else is difficult to say.

Q. 599. Will you state for the purpose of the record what was the character of that waltz? Do you know what it was?

A. It was a very rapid musical composition, with no sustained tones by which the constancy of pitch might have been determined.

Q. 600. Will you please proceed?

A. Tests 23 and 24 were of a piano record. There was a distinct flutter in Test 23, which could be recognized even with this rapid piano record. And since I have heard other PS16 machines give very much better reproduction, I am at somewhat of a loss to know why Test 23 was not better than it was.

In Test 24 the flutter seemed even more pronounced; that is, there was a distinct variation in speed as the record was being reproduced.

In Tests 25 and 26, which were of a constant pitch tone, it was quite evident that a distinct flutter in speed was present in both of these tests. In this case, as in previous tests, the constant pitched tone bringing out the effect of the speed variation much more easily recognized.

Q. 601. Was that variation which was detectable in the constant pitch tone of such a character that it would be seriously harmful to music?

A. Yes, to some types of music it would probably be pretty bad. Two types of music such as those played in Tests 21 and 22, it would probably be inconsequential and probably you would not hear very much of it in jazz music; but in high-grade orchestral compositions, where the tones are sustained, it would probably have a certain effect. I do think that both of these machines were better than many other reproductions that I have heard from commercial machines in theaters.

Q. 602. In regard to your last answer, what machines were you referring to when you said "these machines"?

A. You will have to read my answer.

(Last answer repeated.)

A. The PS16 machine and the alleged early German flywheel patent model.

Q. 603. Now go ahead with the 27.

A. Tests 27 and 28 of the PS1 machine damped and undamped indicated the effect of the damping of this machine. The quality in Test 28 was wholly uncommercial and could be detected even in the waltz selection played.

Q. 604. And what was the quality of 27?

A. Twenty-seven, I should say, was fair; fair, perhaps, to good.

Q. 605. Go on with 29.

A. Twenty-nine and 30 being comparative tests, with a 512-cycle tone, showed very clearly the difference between the machine damped and undamped. The fluctuations were very pronounced in Test 30, and only moderately so in Test 29.

Q. 606. Now will you proceed with 31?

A. Thirty-one was an indication of what might be expected if perfect reproduction could be obtained.

Q. 607. You can skip that. That is a regular tone. Go to 32.

A. Test 32 was of an alleged embodiment of Figure 5 as constructed by the defendants in this case, with no damping on the spring, and consisted of a thousand cycle tone. There was a continuous hunting or pulsation present which varied the pitch of this tone up and down over a very wide range, which was very distinctly heard.

Test 33 was similar to 32 except that damping means had been provided with the spring used; the spring was wrapped with a coating of tape, I believe. This smoothed out much of the irregularity and was improved upon by Test 34, in which a small piece of flexible brass pressed on the film near the point at which the sound was taken off.

The difference between 33 and 34, however, was very slight. Test 35, the 1000-cycle tone, as reproduced by the Defendants' PS1 Reproducer, had a distinct varying fluctuation in it.

Test 36, similar to Test 32, except that a device which the defendant claimed was built according to the specifications of the Amet patent—and in which I cannot agree with him—was used in place of the coiled spring.

While this had a tendency to eliminate some of the oscillations, there were still very strong pulsations present, which to my mind would have made the reproduction uncommercial.

Test 37 had much the same effect as 36. The tone was full of wows—as we speak in common motion picture parlance; that is the pitch went up and down and gave a wowing effect.

Q. 608. Go ahead with the 38.

A. Part 3 consisted of a group of tests on what the defendant alleged to be prior art devices.

Test No. 38 was made on a machine alleged to be substantially the machine shown in the Constable patent: in the first case, with the spring free, and Test 39 a test on the same machine with the spring clamped.

There was a marked difference in reproduction of the waltz record, which was used for both of these tests. A high-pitched fluctuation being noted in the Test 39, which was essentially absent in Test 38.

Q. 609. Forty.

A. Test 40 being a speech record, gave very little indication of any speed fluctuations, as would be expected.

Q. 610. That is, the speech record would not?

A. A speech record gives little or no indication of speed fluctuations.

Q. 611. Forty-one was not run?

A. Forty-one was not.

Q. 612. Proceed with 42.

A. Forty-two and 43 were made with apparatus designed after the Dragoumis patent. Since the first record was speech, the same thing applies.

Q. 613. Did you say designed after the Dragoumis patent?

A. According to the defendants' interpretation thereof. About half of the apparatus shown in the patent was not provided in this particular test.

The speech record gave little or no indication of speed fluctuations, and the march record, being of spirited——

Q. 614. Wait. Was that a march or a waltz?

A. What I heard was a march.

Q. 615. Go ahead.

A. The march being of a spirited and rapid nature, gave little or no indication of any tendency for speed

variations. That is, had speed variations been present, it would not have been so indicated.

Tests 44 and 45 were made from a record rotating over a motion picture sprocket directly connected to a large-sized flywheel, and are stated here to be Reel Film, whatever that may mean.

The speech and waltz record in these two tests gave very little indication of whether or not speed fluctuations were present or not.

Q. 616. Why was that?

A. On account of the type of record produced. The waltz record was rapid music, and the speech record being inherently insensitive to speed fluctuations, did not give much of an opportunity to determine what was taking place.

Q. 617. Proceed with 46.

A. The Hoxie machine and film reproduced an early speech record. The recording was very poor, compared to modern day standards.

Q. 618. The recording or reproduction?

A. Recording and reproduction both.

And, being a speech record, it was difficult to determine whether or not the reproduction was in continuous motion or not. There were several cases where it was quite distinct that the film had been stopped and started up during the process of recording.

Q. 619. Will you proceed with 47.

A. 47, apparatus alleged to have been built

A. Forty-seven, apparatus alleged to have been built according to the French patent to the General Phonograph Company, reproduced a modern high-quality disc record, with modern oil-damped pickup, and indicated a very wide speed variation as the motor came up to speed. It started up with a very distinct wow, but after it had come up to speed and gotten under way, the reproduction I thought was fair.

Q. 620. Forty-eight?

A. Forty-eight was a reproduction from a modern Victrola Talking Machine, using an electrical pickup and high-quality reproducing apparatus, and was quite satisfactory. The type of record did not indicate to any great extent whether or not speed fluctuations were present in this system.

DIRECT EXAMINATION (Continued).

By MR. HASELTON:

Q. 621. Professor Ballard, would you please refer to the Triumph machine which is here in court, Exhibit 31, in connection with a booklet which I have here, entitled "Edison Phonograph, Thomas A. Edison, Inc., Orange, New Jersey," and which bears a date on page 2 of 10/1/11. I refer you particularly to pages 10 and 34 of this booklet, and ask you to compare the construction of the Triumph model as indicated on those pages, with the Triumph Exhibit here, No. 31.

A. The Triumph machine here seems to be the one illustrated in the booklet which you hand me. The booklet which you hand me does not show any flywheel on this machine. As far as I can identify other parts—as the photograph is very small—other parts are identical with the exception that it does not apparently show the added bracket around the end of the frame, and there apparently is some change with regard to the feed screw in the rear of the machine. I do not see on the machine the two home-made set screws shown on this machine Exhibit 31; but otherwise it seems to be much the same.

Q. 622. The thread drive of the needle has been removed from this Triumph machine, has it not; part of it?

A. Part of it has been removed. Provision seems to be still on the machine to drive from the rear lead

screw, although there is nothing which would allow it to be driven from the forward lead screw.

Q. 623. Do you attribute any significance to the flywheel addition here in Exhibit 31 which you referred to?

A. It is quite evident that the model machine shown in the photograph has been altered and auxiliary parts put on, auxiliary end bearing for the shaft, to accommodate this flywheel. The flywheel has been added to the combination and very roughly screwed on to the pulley which is shown in the original phonograph by three screws which are hammered over on their inner ends. The bracket holding the end bearing is quite obviously an addition to the machine that was not present at least when the machine was originally decorated, because it has none of the gold and black striping on it that is present on the rest of the machine.

Q. 624. Would or would you not expect some difference in the results from this machine, used as it is now, as compared with the Triumph machine which is indicated in this booklet?

A. Yes, there should be quite a wide variation in the results to be expected from this machine as compared to the Triumph machine indicated in the booklet.

Q. 625. Will you glance through this booklet and state whether you find any mandrel shafts carrying a flywheel that can be noted in the illustrations in the booklet?

A. On page 6 is an illustration of an enclosed machine which gives no details of mechanism. Page 7 contains what is entitled the Edison Opera Phonograph. As far as can be seen from this picture, there are no flywheels anywheres in the machine.

Page 10 shows another view of the Triumph machine, which has already been discussed. There are no flywheels visible in this picture.

Q. 626. Is or is not the portion of the mandrel shaft visible in the picture, that is, the portion where the flywheel on Exhibit 31 is mounted?

A. Yes, if the flywheel as is shown in Exhibit 31 were mounted on this machine, the view is such that it would be very easily seen.

Page 12 shows the Edison Home Phonograph. It shows the main mandrel in quite considerable detail, and there is no flywheel mounted on the mandrel or elsewhere, as far as I can determine.

The same is true of the Edison Standard Phonograph as shown on page 14. No flywheel is present or visible, although the mandrel driving the cylinder is clearly shown.

Page 16 shows a view of machine entitled "Edison Standard Phonograph, 4-minute only," which shows mandrel and mandrel shaft very clearly, but no flywheel is present.

Page 18 shows two views of the Edison Fireside Phonograph, differing only in type of horn used with these two machines.

Q. 626. Just refer to the remaining photographs more briefly.

A. There are a number of other photographs shown in this book, some dozen perhaps, and in each case the mandrel driving the record, the mandrel shaft, is quite clearly visible, and there are no flywheels shown in any case.

Mr. Haselton: I offer in evidence photostat of the Edison Phonograph booklet referred to as Plaintiffs' Exhibit 43.

Mr. Neave: I object to that, not because it is a photograph, but because there is no evidence that it has any relation to the kind of machine that this purports to be. This machine that is in

evidence here as Exhibit 31 is a machine which purports to be a machine which Edison used in his factory or shop for commercial recording. This Edison Phonograph booklet that has now been offered in evidence obviously is talking to you and to me as users on the particular pages that they have been referring to, which say that the thing that is illustrated on that page is for home recording. That has nothing to do with what this machine in evidence No. 31 was made for or used for, because that was used for commercial recording in the factory, as distinguished from these home recording machines, upon which we would play other records when we did not want to record in the home ourselves. There is a missing link.

MR. WARD: Your Honor, I don't think there is a missing link. I have been trying to get somebody on the stand to testify about this obvious addition here, and all we have here is a statement by one of their witnesses who produced this machine who said that there were some hundreds of them put out on the market. I have forgotten his exact words, but he said that there were several of them, many of them, and it is rather significant that the defendants have put in other Edison books, but have not put in a complete catalogue of Edison phonographs, and this is one we have been able to get hold of recently.

THE COURT: I will receive it for the purpose for what it is worth and overrule your objection for the present.

MR. WARD: The date of it is approximately the date or time that the witness testified it was put out.

(Edison Phonograph catalogue of 10/1/11 received in evidence and marked Plaintiffs' Exhibit 43.)

Q. 627. When this Exhibit 31 was played in the demonstration the other night, was the stylus mechanism on here used?

A. I did not see the demonstration, but I was informed that the stylus mechanism was not used. I saw another very light and sensitive pin stylus mechanism, that is, a mechanism that was used in place of the stylus. I was told that that was the equipment that was used to reproduce the record.

Q. 628. Would that substitution have any significance as to the uniform motion of the record, in your opinion?

A. It would have a very large significance, if not a controlling significance, as regards the uniformity or non-uniformity of reproduction. As has already been testified and, as a matter of general knowledge, the phonograph frequently slows down when it strikes a loud note. The reason for that is very, very simple. It is the same thing when you are sliding along an icy walk. You run into some ashes and you slow up immediately. When there is no sound recording on the groove it is a plain, smooth groove, and just as soon as the sound wiggles are encountered the phonograph needle has more resistance to encounter, and the obvious thing to do, and which obviously takes place is that the phonograph slows up to some extent.

Q. 629. Would the last two questions and answers apply to the Kinetophone which was demonstrated?

A. It most assuredly would.

Q. 630. I will now refer you to the enlarged—or rather, to the model of the Amet patent drum drive. Could you state whether that was in your opinion made in accordance with the disclosure of the Amet patent?

A. The Amet patent is very clear as to the function of this drum with the two flexible heads. It is to prevent mechanical vibrations from being transmitted along the shaft from the motion picture projector into the phonograph which Amet proposed to drive simultaneously with the projector and, in many cases, Amet points out unmistakably that the device is used for no other reason than merely to prevent the transmission of mechanical vibrations, of sound vibrations, along the shaft into the phonograph, because if the phonograph cylinder vibrates it transmits that vibration to the stylus, and that in turn is transmitted back to the diaphragm, and a false sound is sent out. This is totally different from a fluctuation in speed. A fluctuation in speed of the phonograph record will not produce of itself a sound. And so, mere fluctuations in speed do not produce noises as described by Amet in his specification.

Q. 631. Will you now compare the physical structure of that model to the alleged corresponding feature of the Amet Patent No. 1,162,433.

A. At 22, a cylinder or drum with two flexible heads, which Amet specified may be made of oil-tanned leather or rubber, is illustrated. Amet describes this device in his United States Patent No. 1,221,407 as providing—I am reading now from line 86 of page 1, as providing "non-vibration—transmitting mounting means for supporting the sound record machine on the suspended base." This is used in connection with the term at line 95 of the same page, where he speaks of the "non-vibration transmitting coupling," and at line 100 mention is made "to prevent the transmission to the recording stylus of mechanical vibration foreign to the desired phonograph record." As it is noticed here, the idea is to prevent vibrations to the stylus and on to the record. If it had been used to prevent speed regulations of the record, of course, mention would not have been made of the stylus.

Page 3, line 10, the description of this connection is shown:

> "The heads 20 and 21 are preferably of oil-impregnated flexible leather, or sheet rubber, having sufficient tensile strength to transmit the power necessary for rotation without buckling or distortion."

The only way that this piece of apparatus can be used in place of the Tri-Ergon spring is to have it buckle and distort: in other words, this coupling on the upper edge of the apparatus must have possibilities of a relative motion with respect to the big plate if it acts as a spring, and Amet points out particularly that such is not to be in the apparatus as he describes it. That the leather must have sufficient strength to prevent buckling or distortion, and it can only be used as the defendants have used it, when it does buckle or distort.

Q. 632. Will you compare the leather discs with Figure 3 of the Amet patent 1,221,407.

A. The leather discs shown in Figure 3 of the patent show that the thickness of leather in comparison to other dimensions on the apparatus is very much larger on the patent than in this device which is supposed to represent it.

Q. 633. And Figure 2?

A. The same is true in the case of Figure 2. In Figure 2 the leather heads are shown as continuous leather heads, although it does mention that they may be cut out.

Q. 634. To what extent could you state that this buckling occurs?

A. It is quite easy to get a deflection here, I should say, of perhaps ten or fifteen degrees without unduly stretching the leather.

Q. 635. I refer you now to the model of the Tri-Ergon German Patent No. 387,058, and direct your attention particularly to the gate construction. In your opinion is that made, in reference to the other parts, according to the patent?

A. The gate shown in Figure 1 of the German Patent No. 387,058 consists of two strips slightly bent away from the film at their edges and which, as shown in the drawing, do not even touch the film. The length of the gate in comparison to the diameter of the roller, I should say, in this respect, that the length of the gate is approximately the diameter of the roller. As your Honor will see, (witness refers to model, Defts. Ex. 78) the length of this gate in the model is approximately one and a half times the diameter of these two rollers, showing that the gate was not made anywhere near to the scale as shown in the German patent.

Q. 636. Now I will refer you to the top plate of the gate.

A. I notice that the top plate of the gate is adapted to fit very closely with the bottom plate of the gate, and that instead of being a homogeneous medium as shown in the patent, it has two strips of what appear to be fiber, wood fiber, fastened on the gate, so that they rub on the perforations of the film as the film passes through the gate. There is a rough slot milled in the lower half of the gate, which apparently engages the film under the pressure of the fiber strips, to produce undue tension at the gate. Of course, the patent does not even show these two strips in contact with the film.

Q. 637. Is there any excuse in the patent for the fiber strips you refer to: any justification?

A. There is no justification or indication in the patent of the fiber strips, that fiber strips should be used. In fact, it is quite to the contrary. The patent shows the gate as being composed of two homogeneous strips. There is no indication to the contrary.

Q. 638. I refer you to this spring affair which was used in connection with this top plate of the gate. What have you to say as to that?

A. As I saw the apparatus demonstrated, the gate was pressed down from above by a lever arrangement, which was held in place with two strong steel springs, tightly tensed, so that the pressure, as I should judge from merely feeling the tension at the lower end of the lever arm, was several pounds, holding the film down there—exerting a very heavy pressure on the film as it passed through the gate.

Q. 639. I refer you now to the lower roller mounted on the flywheel shaft.

A. The lower roller is not a roller of constant diameter. There is a ridge on the edge, away from the framework. Then there is an undercut portion left rough, and finally, in the middle of the roller, a portion of approximately an inch in width which is turned smoothly, then another space left rough, and finally a projection or an edge on the inside edge of the roller. The top roller is made much the same way. They are not uniform rollers.

Q. 640. The mounting of the top roller.

A. The mounting of the top roller is shown to be flexible to take care of any weaving that might occur as film passes between such rollers, which is known in many cases to be a very serious factor in progressing film over smooth rollers.

Q. 641. Did you find any such mechanism as mounts the top roller in the German patent you are referring to?

A. There is no such mechanism indicated or described in reference to that anywhere in the patent.

Q. 642. Did you refer to the spring holding the top mounting for the top roller?

A. I find that there is a very heavy steel spring pulling down with extreme pressure on the top roller

to hold it in contact with the lower roller and, inasmuch as the emulsion side of the film, as I saw it demonstrated, goes next to the flywheel roller, it of course would not be very long before there would be no picture left on the film. It would have chewed the emulsion off the film.

Q. 643. Would you compare the relative sizes of the two rollers that pinch the film—I mean in dimensions and not inches—as compared with the gate, and compare those two elements and dimensions with the corresponding elements shown in the patent as to dimensions? I mean in proportions, not in inches—relative proportions.

A. The length of the gate is considerably more than the diameter of the roller on the model. Perhaps once and three-quarters or thereabouts. The length of the gate in the patent drawing is certainly not over the diameter of the roller. The gate, in other words, is made twice as long as there is any teaching, or nearly twice as long as there is any teaching in the patent.

Q. 644. In your opinion, is this a fair representation of what is shown in the German patent?

A. It is not. It departs in many and essential respects from the showing of the German patent.

Q. 645. I refer you to the roller over which the film passes after it passes through the two pinch rollers. Is there any significance in your opinion to the use of such roller at that point?

A. Yes, that has a distinct tendency to guide the film in its passage through the apparatus, and has a tendency to keep it on the roller and connect it with the flywheel and the follow roller. Nothing of this character is shown in the original German patent.

Q. 646. Would or would not that have any effect in keeping the film in better focus?

A. Yes, it would in my estimation.

Q. 647. Does the patent illustrate or describe any arrangement in which the pinch rollers engage the film after it passes through the gate and at a point between the pull roller and the gate, as distinguished from, say, after the pulling roller?

A. No, there is no means of any character indicated in contact with the film between the point at which it passes through the rollers and the driving sprocket.

Q. 648. In the patent?

A. In the patent.

Q. 649. Does the patent refer to any sprocket by name?

A. The patent does not refer to any sprocket. It merely says that a roller may be used to drive the film. And of course in connection with steel bands or with wires, a sprocket would not be appropriate.

Q. 650. I refer you to the machine over here which was demonstrated as a representation of Figures 5 and 6 of the patent in suit, and particularly I refer you to the manner in which the film was retained on the sprocket.

A. The sprocket in this apparatus is recessed essentially over the part of the film which bears the picture. That is, the film only has a chance to bear on the sprocket at its two edges.

Q. 651. How wide are those bearing areas, approximately, or state how wide they are as compared to the total width of the film.

A. They are relatively narrow as compared with the total width of the film. There is a supporting area outside of the row of perforation of probably three thirty-seconds of an inch, and one inside of the row of perforations of approximately the same amount.

Q. 652. And what is the condition of the narrow surfaces with which the film does contact adjacent the sprocket teeth?

A. For some reason or other they apparently have not been machined, and they are very rough.

Q. 653. Would that have any significance in the quality of the sound reproduced?

A. It most assuredly would. It would produce irregularities of engagement of the teeth of the sprocket with the film, and disengagement.

Q. 654. Now, will you put a piece of film in place and pull the film back and forth a bit, and see how much play or possible up and down movement there may be on the sound track portion of the film as it passes the point of translation.

A. There is a possibility of a considerable up and down movement here, because the rollers are contacting only over on the inner sprocket hole, around the inner holes of the film. The rollers do not contact with the part of the film that projects or any other parts which projects over the edge of the roller. The rollers are apparently specifically provided so that they do not support the film at critical places.

Q. 655. In your opinion is that in accordance with the teaching of the patent and the description therein of Figures 5 and 6 or of Figures 3 and 4?

A. There is no indication of any such special roller or special cutting away of the rollers in either of these figures.

Q. 656. What does the patent say the rollers are for?

A. I have forgotten the exact wording.

Q. 657. In substance.

A. To press the film against the sprocket. And in the model they contact with a very small portion of the film. Perhaps not over one-eighth of an inch wide.

Q. 658. Did you ever see a commercial sound reproducer in which there were presser rollers of any form, or retaining rollers in which there would be

flanges on the rollers adjacent both rows of perforations, and still having the flanges on the sound track side, bearing against no surface beneath?

A. No, I have never seen that construction.

Q. 659. Will you take hold of the overhanging sound track area of the film and see approximately how much up and down movement can be given to that portion?

A. It is quite considerable. I hesitate to say how much. It is enough to effectively throw it out of focus at its maximum value.

Q. 660. Will you now direct your attention to the spring for driving the flywheel and compare that with the spring taught by the patent in suit?

A. The spring used to drive the flywheel is of small diameter and unduly stiff. There is apparently an abnormal amount of friction in the bearing, because the bearings are of the very crudest type, that is, a steel rod in a cast-iron hole; and therefore it was probably necessary to make this spring much stiffer than would have been the case had a commercial type of model been produced.

Q. 661. Would it be reasonably possible to make a spring as small as that or even smaller and yet not have it so stiff?

A. Yes, it would be possible. I note that this spring sets the flywheel into motion before it is moved more than, oh, perhaps a quarter of its travel between its mid-point and the stop on the far end.

Q. 662. That is, you can start the flywheel before there is any engagement between the stops?

A. Oh, yes. Yes, indeed. There is quite a wide factor of safety there.

Q. 663. Did you observe what sort of a motor was used to run this machine?

A. I examined the three motors on the three motion picture equipments in the defendants' exhibit and

found that two of them were what is known as induction motors. The motors driving the defendants' PS1 reproducer and the PS16 were both induction motors, as far as I was able to determine.

The motor on the experimental model, for some reason or other, was not of the type shown on the other two machines, but was of the type known as a synchronous motor. A synchronous motor runs at exactly constant speed and has many advantages; but one of its very serious disadvantages is that it has a tendency to hunt, as we say in engineering—that is, the pull of the motor is not of a constant character but varies in pulsating form.

And of course a motor of this sort would be the best type of motor to use if you desired to make this equipment inoperative.

Q. 664. Would that tendency of the motor to hunt have any effect on the mode of operation of this model, assuming the spring is undamped?

A. It most certainly would. If the tuning of the flywheel and the spring had been in the proper range and the proper type of drive from the motor, it might be quite possible to keep the flywheel and spring in continuous oscillation, pulsating back and forth in a vibration which would not die out with time.

Q. 665. I refer you now to the Dragoumis model. First I will refer you to the photographs of the model that is being brought in. I first direct your attention to the film. In your opinion is the film shown there in accordance with the Dragoumis patent?

A. The film departs entirely from the teaching of the Dragoumis patent in two respects:

In the first place, the Dragoumis recorder shows what is known as a hill and dale record; that is, it is made by a cutting stylus or indenting stylus which moves up and down with respect to the film and not back and forth across the surface of the film.

In the record which was shown and reproduced, a lateral-cut recorder had been utilized and the record made in this fashion.

Dragoumis points out specifically that one of the great advantages of his invention is that he may use a record which is recorded on both sides. One of the principal objects of the invention is to provide a machine which can record a very long record on relatively little material. And for that reason, Dragoumis specifies that the record should be run at a very much reduced speed.

In investigating it I found that a lateral record had been used, made by equipment entirely foreign to the patent, which was not even known at the date of the patent—the film had only been recorded on one side—and that a speed of reproduction was used which was in excess of even the standard motion picture film speed as at the date of the Dragoumis patent. I was not able to get the exact values on the length of the film, but a brief checking with my watch and measurements seemed to indicate that the speed of reproduction was around 75, 74 feet per minute; and at the date of the Dragoumis patent, the normal speed of film reproduction was even slower than that.

So instead of reducing the speed of the film they had actually increased it beyond normal motion picture practice.

Q. 666. What would be the effect of recording hill and dale records on film on both surfaces of the film?

A. It would mean, of course, that a very thick strip of celluloid would have to be used. Because if you are indenting a hill and dale record the record extends through the film and is present on both one face and the other face. If you want to cut it, you might be able to make a very, very light cut and cut on both faces; but certainly an indented record could not be used.

Q. 667. And if you used a thicker record, would that have any effect or be liable to have any effect on the motion of the film through the machine?

A. A thicker record would be much harder to progress and would require a stiffer and more thorough progressing mechanism to progress it at the constant speed.

Q. 668. I refer you to the Dragonmis patent, Figure 2. Do you find any of the parts mounted to the right of the shaft marked 2 in the model?

A. About half of the equipment specified in this patent, and practically all of it which would be liable to produce speed irregularity, is not present in this model.

The patent shows definitely a series of gearing from the main shaft and, as has been pointed out, gears quite frequently introduce irregularities; a feed screw, somewhat similar to the one present on the Edison machine, which was not used in the demonstration and which would have the effect of introducing speed irregularities in the operation of the machine.

A further difference that I might point out to the Court is that the faster any flywheel revolves the more effective it is as a flywheel. So that any flywheel effect that may have been present at seventy-five feet per minute would have been reduced down to one-quarter had the film been run at thirty-seven and one-half feet a minute, and proportionately.

Q. 669. Do you find any teachings or mention or speaking in the patent on the subject of flywheels or the like?

A. The patent does not mention flywheels anywhere. There is no mention whatsoever of flywheels or of flywheel effects. In fact, there is little or no description with regard to this wheel which is assumed to, in some cases, to be the flywheel.

As a matter of fact, the kinetic energy in the small driving motor—since it revolves very much more rapidly than this wheel—is many times as great as any flywheel effect produced by this pulley wheel. And that can be very easily demonstrated or computed mathematically.

Q. 670. Now refer to the belt going over the large pulley.

A. The belt going over the large pulley is a thin leather belt of considerable flexibility. Such was of course not specified in the Dragoumis patent; there is nothing said about the belt at all.

Q. 671. Would the use of a flexible belt have any effect one way or the other in improving the sound or not?

A. The use of a flexible belt under certain conditions may have a tendency to take out some of the irregularities of motion.

In this case I think the flexible belt had little or no effect, because the special phonograph motor used to drive this apparatus has a centrifugal governor and every provision made to give constant speed.

Q. 672. What kind of a motor was used with that?

A. I understand that the motor—which your Honor cannot see, because it is underneath the platform here—is a special type of Dictaphone motor with flyball speed governor of high precision, designed from every standpoint to give extremely accurate speed.

Q. 673. Will you now refer to the Constable machine, and particularly the spring part used in connection with the mandrel, and compare that to the Constable patent.

A. The apparatus known as the Constable machine, as I understand it, was built especially for this demonstration. It is not, according to my knowledge, a commercial piece of apparatus, but was built for

this particular case. The patent No. 1,425,177 shows at Figure 2 what is described as a detail of the two U-shaped springs through which the record cylinder is driven. The thickness of the springs is quite evident from this figure. I should say, in respect to the enlarged size which this model shows, that the spring should be approximately a sixteenth of an inch thick.

That is quite evident from the drawings of the patent.

These springs are described as pressing lightly upon the opening shown in Figure 2, labelled 11.

In the construction of this machine I find that the springs press approximately half their—almost half their length upon this opening. But instead of pressing lightly upon it they are expanded, so that they exert a very considerable heavy pressure against the side. And instead of using springs of anywheres near the dimensions or size specified in the patent, two tiny thin pieces of watch spring, clock spring, have been used, approximately about five-thousandths of an inch in thickness.

This of course to my mind completely departs from the teachings of the patent.

Q. 674. Would you refer to the governor portions of this mechanism and the gear drive for it, briefly?

A. It is quite possible to make a worm-gear operating on the same shaft with the cylinder mandrel. And if the worm is properly cut and the machine work done nicely, the gear introduces little or no irregularities into the motion of the cylinder. That same general setup can be seen in another one of the defendants' exhibits, where it was desired to make the motion smooth.

In this case it was desired to make the motion as rough as possible.

There is no lubrication and was none, as far as I could determine, on the pressure pad for the governor

at the date of the exhibition, which would cause an additional irregularity. And, of course, all of these contributing together caused the machine to operate very poorly unless the springs were used.

Q. 675. The cylinder you referred to is the cylinder that is supposed to carry the record cylinder?

A. The cylirder record, yes.

Q. 676. That is about how long? Or rather, compare the weight, if you can, of that in a general way to determine that of a sound film record.

A. That cylinder, for some reason or other, seems to be made out of paper or some very, very light material. It is apparently quite light.

Q. 677. Well, the end plugs?

A. The end plugs are of brass. And of course, as far as compared with film record, its inertia is very considerable.

Q. 678. Now, will you refer to the enlarged Constable model which was used in connection with the demonstration of the Figures 4 and 5 of the patent in suit, and compare that with the Constable patent?

A. In connection with Test 37 of the demonstration, the spring in the alleged Tri-Ergon model was removed and the device which I hold in my hand was substituted, it being alleged, according to my understanding, that this represents the apparatus shown in Figure 2 of the Constable patent.

As your Honor will see, when I remove these clips the springs fly out to almost twice their original position, notwithstanding the fact that Constable is very definite in saying that the springs should press only lightly upon the end pieces. The contact of the spring with the end clips was very considerable, although shown as a mere line, little more than a line contact in the patent.

The strength of these springs is completely out of proportion to the drawing of Figure 2. In order to

make the springs correspond with Figure 2, they would probably have to be ten times as thick as they are at the present time.

Q. 679. Would there be any damping in connection with those springs as used in that model?

A. There would be no damping of this device if built in accordance with the Constable patent, because the Constable patent says that the springs touch lightly upon the contact pieces. And of course, if they touched lightly when one spring were depressed, the other would completely leave contact with the other side of the equipment.

Q. 680. Come over here, please, and refer to the General Phonograph model, as compared with the alleged corresponding French patent.

A. The General Phonograph model is interesting in showing what can be done when it is desired to make the mechanism work. Because on this shaft is a worm-gear, geared to a flyball governor of almost identical characteristics with the one shown in the Constable exhibit.

Now, this machine, the General Phonograph machine, as your Honor noted, gave very nice results. It did not have speed fluctuations introduced by the gear balls, where the other machine was quite to the contrary, although the mechanism is very, very similar in each case.

Q. 681. You have not had time to measure accurately the gears, have you?

A. I have had no opportunity, I haven't the measuring instruments here to do it.

Q. 682. Would you refer to the so-called Edison Skeleton model here. In your opinion, does that correspond to any prior art that has been set up?

A. Not to my knowledge. It has what appears to be a lateral-cut record on a shaft with a flywheel. In fact, I don't know just exactly where it does fit in.

Q. 683. That is operated by what kind of a motor?

A. The motor is not here in court. I really do not know what motor was used. Some type of constant speed motor. There are no inherent sources of speed fluctuation here, and it is of course not difficult to drive it at constant speed.

Q. 684. Is there a record on only one surface of this film?

A. That is my understanding.

Q. 685. And how is that played?

A. That is played of course with an electrical pickup, which has a minimum amount of friction at the stylus point.

Q. 686. I refer you now to the "reel film" model, so called. Does that correspond in your opinion with any prior art that has been set up here?

A. As far as I know, it does not. It is very similar to the previous model, except that it uses a continuous film rather than a loop film. It has a very heavy flywheel, and is driven by what appears to be a constant speed motor.

Q. 687. I show you a photograph of the Kinetophone as demonstrated and direct your attention to the pickup. Will you explain briefly to the Court how that pickup is mounted?

A. The reproducing stylus used in the tests on the Edison Kinetophone—with the exception of Tests 1 and 2—was entirely different from that originally furnished with the machine.

As your Honor will see, it is a very light mechanism mounted on the end of a long hollow rod.

The end away from the machine is counterweighted with a small weight, so that the pressure on the record itself is almost infinitesimally small. Now, there is a very good reason for that. The records which were demonstrated were not commercial records at all but were so-called wax records made in the proc-

ess of making commercial records. They are cut on a very soft composition, waxy composition, which must be maintained at a fairly low temperature. And in playing them back, that is, testing the record, it is necessary that the reproducing stylus must have little or no pressure on the record. Otherwise the record originally recording this very soft wax would be completely obliterated. And this device was especially designed for that type of work.

Now, since it has little or no contact pressure with the record, there is no friction of any appreciable amount introduced when the machine strikes a loud tone: which was of course a very obvious advantage to the defendants, because it eliminated one source of speed irregularities which is always present in the operation of such machines in the normal way.

There was another factor involved which I think I shall call attention to and that is there was no load put on the progressing screw; that these pickups were hinged near the counterbalance weight and merely moved across the record from one end to the other due to the pull of the record groove itself.

The machine had no load in progressing the series of gears and in operating the shaft drive for the amplifier—which your Honor has doubtless seen.

All of this type of irregularities was eliminated in the demonstration of this machine. So that of course the effect of the irregularities in actual commercial use of this machine was completely removed.

Q. 688. Does that answer in general apply to all of the demonstrations from stylus records which were given the other night, with the exception of the two original Edison records?

A. That same condition applies.

Q. 689. And the film records?

A. That same condition applies to all of the records which were made on cylinders, all of the special

records which were made on cylinders, with the exception of Tests 1 and 2. They in no way represented actual commercial conditions.

Q. 690. In connection with the model of the old German Tri-Ergon patent, you referred, I believe to sidewise weaving of the film between the pinch-rollers being liable to occur; or rather, being liable to occur with the structure shown in the patent.

In that connection I refer you to an article by Edward W. Kellogg, of the R. C. A. Victor Company, Inc., in Volume 15, No. 5, of the Journal of the Society of Motion Picture Engineers. You will find that subject discussed in that article. The date of the publication is November, 1930.

A. Yes. Mr. Kellogg goes to considerable length to outline the difficulties, instability and various other tendencies for the film to weave off the roller where smooth rollers are used, and shows to what length it was necessary to go to overcome that difficulty.

Q. 691. Would you read the portions of that article that you consider significant in connection with that question?

A. The statement is made on page 664, near the bottom of the page, "A change which gave the film a substantial wrap around the guide roller cured this difficulty."

In the original German patent there was no guide roller around which the film was given a substantial wrap disclosed.

In the defendants' model—which is alleged to represent the German patent—such a roller is shown and utilized in the equipment.

(Article on page 664 of Journal of the Society of Motion Picture Engineers, issue of November 1930, by Edward W. Kellogg, received in evidence and marked Plaintiffs' Exhibit 44.)

Q. 692. I refer you now to patent to Maurer, assignor to Radio Corporation of America, No. 1,891,387. Do you find in that patent any discussion of the feature of curving film around a roller or otherwise curving the film at the point of translation and the advantages of such a method?

A. Yes, the patentee shows the film curved around the roller 11 of Figure 1 and points out in a number of places, the advantage which accrues to such bending of the film at the point of reproduction or recording. In this case it is reproduction. Do you want me to read further from the patent, or just to make a general statement in this respect? I think the Court can see there are a number of references in this patent, and I will be very glad to——

(Maurer patent 1,891,387, received in evidence and marked Plaintiffs' Exhibit 45.)

By Mr. Ward:

Q. 693. Professor Ballard, will you refer to some of these patents that Mr. Waterman discussed. Take up first the Edison patent 200,521.

A. This patent—apparently the original Edison patent—describes a phonograph. The illustrations are shown in Figure 1, in which a drum or cylinder, not otherwise described, is fastened on a threaded shaft and driven by clockwork.

The material used for recording the sound is tinfoil, heavy tinfoil—rather, metallic foil, and other yielding material, and clamped tightly around the surface of the cylinder, which has been previously grooved.

Many different ways of utilizing these principles are specified. There is a very interesting statement on page 2, beginning—the lines are not marked here. It is near the bottom of the first column: "A wide continuous roll of material may be used, the diaphragmatic devices being reciprocated by proper mechanical

devices backwards and forwards over the roll as it passes forward; or a narrow strip, like that in a Morse register."

In other words, there were apparently many ways in which Mr. Edison sought to record and reproduce sound.

In addition to the continuous rotation shown on the cylinder he also proposed to move the stylus back and forth over a strip. And of course the stylus would have to come to rest as it reached one edge of the strip before it could start on its travel back and forth.

Mr. Edison points out here the possibilities of using reciprocating oscillating motion for recording sound, as well as continuous motion.

Several different schemes are used. Two of a rather fanciful nature are shown. In Figure 3, a proposal is made to make a record by pressing a thread into the surface of some soft indenting material. The diaphragm operated by the sound is supposed to zigzag the thread back and forth across the record, and then it is passed between two rollers and the thread indents a record into the soft material.

Of course, in the light of present-day knowledge, we know that such a thing is totally impracticable and inoperative.

Another device which Mr. Edison apparently had in mind is shown in Figure 4, in which an ordinary writing pen, apparently, is caused to press with more or less pressure upon some sort of moving strip, and to produce a record of the movements of the pen of varying width.

The system which Mr. Edison proposes to use for reproducing this is rather interesting, because it depends upon the difference in friction of the line as it is widened or narrowed passing upon some type of reproducing device which is not described in any great detail.

In the light of present-day knowledge, we would consider that a mere fanciful suggestion.

Q. 694. Does he say anything here at all about the character of drive, the speed, or anything?

A. Nothing other than that which might be gained from the mention of clockwork. A clockwork drive might be almost anything. He very definitely specifies one kind of drive which moves the diaphragm back and forth. Of course, that is not a uniform motion form of drive, nor can it be, and no particular attention is paid to uniformity.

Q. 695. Now, will you take up the next Edison patent referred to by Mr. Waterman?

A. I am now referring to the Edison Patent No. 227,679.

ALFRED MUELLER, a witness produced on behalf of the defendant, being first duly sworn, testified as follows:

DIRECT EXAMINATION.

By MR. ASHTON:

I live in Springdale, Connecticut. My qualifications to testify as to the German Patent Law are as follows: After I had finished my education, equivalent to a college education in this country, I visited the Universities of Bonn, Berlin and Munich, and was graduated from the last-named university upon the finishing of a treatise on the Protection of Invention and Legislation Relating Thereto, and then I practiced upwards of two years in the German Patent Office before I came to this country, where I continued my practice and kept in touch with the German Patent Office, filed applications, filed appeals, petitions and so forth, and also obtained all the latest commentaries on German Patent Law.

This book contains a text of the German Patent Law, text of the law of Gebrauchsmuster and the text of the law relating to trade-marks.

This is a correct translation of Section Seven of the German Patent Law: "The term of the patent is eighteen years. This term begins to run with the date following the date of the application of the invention. If an invention is for the improvement or other further development of another invention protected by a patent in favor of the applicant, he can ask for the grant of a patent of addition which terminates with the patent for the prior invention. In case the main patent is cancelled by declaration of nullity or by revocation or by withdrawal, the patent of addition becomes an independent patent. Its term is determined by the day of commencement of the main patent."

In Germany taxes are paid on main patents throughout the life of the main patent. On Patents of Addition, only the taxes for the first year are paid, and afterwards, no taxes need be paid thereon.

There is a vital difference in the law and practice in Germany with respect to the granting of patents of addition in the two instances, namely, where the main patent has already been published; and secondly, where the main patent has not been published. If the main patent has already been published, it constitutes prior art. If it has not been published, it cannot be cited as a reference against the granting of a patent or patent of addition. Under the German Patent Law patents of addition have to relate to the same subject matter as the main patent.

Q. 8. Are or are not patents of addition frequently granted in Germany merely for constructional forms, or slightly modified embodiments of the invention shown in the main patent?

A. Well, that would be only in the event that the main patent has not yet been published and therefore does not constitute a reference.

Q. 9. Is there any difference in the German practice as compared with the United States practice with respect to illustrating every arrangement described in a patent specification?

A. Yes; there is quite a considerable difference in this way, that in the German practice it is sufficient if the construction is described in the specification. It does not need to be illustrated, that is, especially with respect to modifications which are mentioned in the specification but not illustrated. If I may mention also the fact that there is this vital difference, or considerable difference, between the practice here and the practice in Germany, in that the German Patent Law does not require that the applicant is the inventor. Anyone can apply for a patent. Even a company can apply for a patent direct. That is, the person who makes the invention or the persons who make the inventions do not have to apply in their own names, but the owner can apply. That is sometimes referred to as the person in possession of the invention.

I have determined that the principle of law which I have referred to as regards the main patent not having been published before the patent of addition was applied in connection with the nullity decisions with respect to German Patents Nos. 389,318 and 389,319.

I find in the nullity decision with respect to Patent No. 389,318, the following, at pages 5 and 6 of the translation:

> "In that the main patent which has as subject matter the disposition of these rotating masses at the point of control was not previously published, so also the special arrangement at the point of control between the rollers provided with rotating masses or on the circumference of a roller provided with a flywheel, must be regarded as a

patentable invention, even though the arrangement between two rollers or on the periphery of a roller per se, but without the use of special flywheels, was known."

I find this statement with respect to the nullity decision relating to German Patent No. 389,319, page 7 of the translation:

> "In that neither the main patent 387,058 in which the flywheel in the vicinity of the place of control is claimed per se, nor the Patent of Addition 389,318, to which the patent under attack is an addition, were prior publications, and therefore the special arrangement of combining the sprocket roller advancing the film with the flywheel, has not been proved as known, the subject matter of this patent of addition must be considered as a patentable invention."

I am familiar with the authorities of the courts in Germany relating to this question to which I have last referred. There is a decision by the Supreme Court, dated January 26th, 1897, where it says:

> "Although the granting of a patent of addition is based on the existence of an invention,"—and then there is something omitted,—"the decision of the Imperial Patent Office in harmony with this principle states that the process of the attacked patent only then would be entitled to patent protection if, with the production of the esters mentioned in the patent of addition as compared with those described in the main patent, an essentially new technical effect could have been shown."

That is a decision of the highest court in Germany.

Here is another decision by the German Supreme Court, dated December 17th, 1932. It says:

> "The main patent has not been published prior to the patent of addition; therefore, it does not belong to the state of the art. The patent of addition must be maintained if that which it discloses beyond the subject matter of the invention of the main patent proves of inventive character as compared with the state of the art to be considered."

(Two decisions of the Supreme Court of Germany, received in evidence and marked Defendants' Exhibits 146-A and 146-B.)

The following is a correct statement with respect to the three German patents which I have mentioned, and also German Patent No. 387,058: that the German Patent No. 387,058 is the main patent; that German Patent No. 389,317 is a patent of addition to the main patent 387,058; that Patent 389,318 is a patent of addition to the Patent No. 387,058; and that Patent No. 389,319 is a patent of addition to Patent No. 389,318, which is itself an addition to the main Patent No. 387,058.

CROSS-EXAMINATION.

By MR. WARD:

XQ. 21. You referred to the decision in the opposition of Patent No. 389,318, wherein it is stated that:

> "In that the main patent, which has as subject matter the disposition of these rotating masses at the point of control was not previously published, so also the special arrangement at the point of control between the rollers provided with rotating masses or on the circumference of a roller provided with a flywheel, must be regarded as a

patentable invention, even though the arrangement between two rollers or on the periphery of a roller per se, but without the use of special flywheels, was known."

Does that decision state that if the main patent had been published that the opposition would have been sustained?

A. The annulment, you mean?

XQ. 22. The annulment.

A. It would have been sustained; that is right.

XQ. 23. Does this decision so state?

A. It is clearly implied in the decision in my opinion. It does not state it literally, but it says that the main patent which has the subject matter, the disposition of the rotating masses at the point of control, was not previously published.

XQ. 26. Doesn't it state in effect that since the main patent was not published——

A. Was not previously published.

XQ. 27. Was not previously published?

A. That means prior to the application for the patent of addition.

XQ. 28. That since the main patent was not previously published, and since the main patent is valid, the question of the validity of the additional patents need not be considered—that is what it really states, isn't it?

A. It says that because the main patent was not published prior to the application for the patent of addition, for that reason the petition for annulment was dismissed on that ground.

XQ. 29. On that ground?

A. Yes.

XQ. 30. That since the main patent, which is valid, was not published they will not consider the question of whether the patents of addition are patentable over that?

A. Yes, but it does not say anything about the main patent being valid. It merely says that the main patent was not a publication and therefore not a reference.

XQ. 31. You know the German law, don't you?

A. I do.

XQ. 32. Suppose that the main patent had been held invalid, would the opposition, the annulment proceeding, have succeeded or failed on the patent of addition?

A. But that is a hypothetical case. That is not the case here.

XQ. 33. I am asking you as an expert on German law. You have expressed your opinion as to what this decision means, and I am asking you: suppose the main patent is held to be invalid by the Court, and in an annulment proceeding on the main patent, would the Court hold the patent of addition valid in an annulment proceeding on the patent of addition?

A. Well, whether the main patent was valid or not does not enter, because what is the decisive point in this case is whether the main patent was published prior to the application for the patent of addition, not whether it was valid or invalid. In either case, if the main patent was a publication and therefore could have been cited as a reference, then the patent of addition in the first place would not have been granted.

XQ. 34. Well, does the Court here state that if the main patent had been published the annulment proceeding on the patent of addition would have been successful? Does it say that?

A. It expresses it in a negative way.

XQ. 35. That is your interpretation?

A. That it was not published at the time that the patent of addition was applied for, therefore, the suit for the annulment had to be dismissed.

XQ. 36. That is all it says?

A. That is what it clearly implies in the language. It says so practically.

XQ. 37. All it says is that since the main patent has not been published, the patent of addition must stand.

A. Right.

You can have a situation where the patent of addition is nullified and the main patent is sustained. And you can have a situation under the German law where the main patent is nullified and the patent of addition is sustained. You can have both.

XQ. 42. Now, I refer you to the German court's statement on page 7 of the annulment proceedings, with respect to the German Patent of Addition No. 389,319, wherein the Court states:

> "In that neither the main patent 387,058 in which the flywheel in the vicinity of the place of control is claimed per se, nor the Patent of Addition No. 389,318, to which the patent under attack is an addition, were prior publications and therefore the special arrangement of combining the sprocket roller advancing the film with the flywheel has not been proved as known, the subject matter of this patent of addition must be considered as a patentable invention."

Your answer to my questions with regard to the previous opinion I referred you to are the same as to this one?

A. Yes.

XQ. 43. Now, you have had experience, I suppose, in handling the applications for Germany that originated in the United States and vice versa?

A. Yes, many.

XQ. 44. Isn't it a fact that in many instances you have a situation where in the United States you may

have two or three separate and independent patents on a certain line of development of related inventions, whereas in Germany you may have covering those same two or three United States patents or the ideas in them, you may have a main patent and two or three patents of addition? Do I make that clear to you, Doctor?

A. Yes, I understand the question. Of course, if the various inventions could be combined in a single application in Germany, if they relate to the same subject matter. But of course if they originate successively in time, then of course you could apply in Germany instead for another main patent, you could apply for a patent of addition for a further improvement or development.

In other words, while in America here we may have, let us say, three patents on three related inventions of a development, in Germany you could have one main patent and one or two patents of addition, so long as the latter two related to the subject matter of the first two.

And the reverse also true, that frequently where you have in Germany a main patent and one or two patents of addition, that you can combine those into one United States patent. I have done that.

And I should say it is true that under the interpretation of patents and claims under the German law it is quite different from that in the United States.

XQ. 48. Under the German law and under the German practice, they leave much more to the imagination or to the knowledge of the man skilled in the art than we do under the American law and practice? They regard the ordinary man skilled in the art in Germany as having much greater knowledge than we regard them here in America?

A. As a rule, that is true.

XQ. 49. In Germany you frequently will have a description of say a page and a half or two pages and maybe one small drawing to illustrate a patented invention, which in America will require maybe fifteen or twenty pages of specification and seven or eight sheets of drawings: That has been frequently your experience?

A. Well, I would not go quite as far as that.

XQ. 50. Substantially?

A. Well, it depends very much of course upon the invention involved.

XQ. 51. Would you go half that far?

A. Well, I have never had any case where I had that exact illustration.

XQ. 52. It is a very common practice with you, isn't it, to condense a description of an American application and drawings, to condense them down very materially when you file the same invention in Germany?

A. Well, we condense the specification.

XQ. 53. And the drawings frequently, too?

A. Well, unnecessary details are omitted, yes.

XQ. 54. In other words, in America and under the American practice and law, they require for a patent to disclose something that it must clearly disclose what we may call the means for carrying out the idea?

A. Yes, that is a fact.

XQ. 55. And in Germany what they require is merely enough to disclose the idea?

A. Well, I may say the specification has to be——

XQ. 56. The principle of the idea?

A. Any modifications, it is sufficient if they are referred to in the specification without being shown.

XQ. 57. You are familiar with this main German patent which these oppositions relate to?

A. Yes, I am.

XQ. 58. Are you familiar with Claim 1, for example?

MR. ASHTON: I object to that, your Honor. Mr. Neave stated at the opening that we put Dr. Mueller on to state the law and not on the subject matter of the patents involved. We will be here a long time if we go into that.

MR. WARD: Your Honor, the decision deals with the claims.

MR. ASHTON: I asked him merely with respect to the law.

MR. WARD: I know you did, but I hardly think it is fair to this Court or to me to have him take the stand and testify to what these decisions mean with respect to these claims, and then try and shield him from the claims to which the opinion relates.

THE COURT: Well, I would not go into it further than you must.

MR. ASHTON: I have called him just as to the principles of law involved, and not as to the subject matter at all.

THE COURT: The law without its relation to this case? Just the law abstractly?

MR. ASHTON: Abstractly, completely. There is no relation to this case at all. The only thing that we asked him were straight questions of law.

THE COURT: Isn't that correct, Mr. Ward? He simply asked him as an expert on the German law to state what the law was relating to certain patent matters. Does that have any relation to this case any more than to any other case?

MR. WARD: Except that they have referred him to the decisions on the claims in these German patents.

MR. ASHTON: We only asked him——

MR. WARD: And asked his opinion of them. And the Supreme Court cases on that.

MR. ASHTON: It is perfectly clear, your Honor. There were three nullity decisions in the German Patent Office, and those decisions state the principle of law which I asked Dr. Mueller to also state in connection with the Supreme Court decisions of Germany. That has nothing to do whatsoever with the subject matter of the patents and, if we go into that, we just have to go over all this expert work that we have been doing.

THE COURT: I don't think we ought to go into general matters of this kind more than we must, to explain this opinion of the law.

I will allow you to ask him about the application of the law to this German patent, briefly.

MR. WARD: That is all I want to do, your Honor. Just one or two questions.

Q. 59. Doctor, take Claim 1.

MR. ASHTON: If we are going into the claims, your Honor, we will be here forever. It is just a matter now of putting Dr. Mueller on as a patent expert, the same as Mr. Waterman and Professor Ballard or anyone else that has been here to testify and, as we have got to go into this, it is going to take a long time.

THE COURT: I do not see why we should go into these different patents and machinery. I am just afraid that if we get started in that we are never going to stop.

MR. ASHTON: It is a principle of law in Germany, just the same as you would look up a book, excepting that our law is that in order to prove the law you have to call somebody who knows the

law. If I could have offered the statute, I would have done it and would not have called Dr. Mueller at all, but the law is in this country that if you want to prove a foreign law, you have to prove it as a fact, and that is the only reason for having the witness at all, so it has nothing to do with the patent.

THE COURT: Didn't you examine him specifically on the decisions relating to these German patents?

MR. ASHTON: Just the principle of law as stated in those decisions, which I want to prove as the law, the same as I proved the statute, and then the Supreme Court decisions.

THE COURT: I guess we will have to go to the notes.

MR. WARD: I don't think we have to go to that trouble. You did refer the witness to the decision on the patent, didn't you?

MR. ASHTON: Yes, because it states the law in there.

THE COURT: I will allow you to cross-examine him on that where it relates to these patents, but if he has simply asked what is the law on a certain phase of patents generally then I don't think you should examine him on the patents in question.

MR. WARD: I agree with you, your Honor, but he referred him to particular decisions on these German patents.

THE COURT: Very well; then you may go ahead.

XQ. 60. Doctor, referring you to Claim 1 of the main patent, is that claim limited to any particular kind of elongated or linear phonogram carrier?

A. It is directed to phonographs for the uniform operation of linear phonogram carriers.

XQ. 61. Any kind?

A. Yes.

XQ. 62. Is the claim limited to any particular arrangement of the flywheel mass with the elongated carrier so long as it is coupled with it to control the speed in the way stated there?

A. Well, it is limited to the arrangement of a rotating flywheel mass in connection with a phonogram carrier at the place of control.

XQ. 63. But it is not limited as to how the flywheel mass is to be coupled with the carrier? That is, the coupling means.

A. It merely states here in the claim that the phonogram carrier is coupled with a rotating flywheel mass.

XQ. 64. It is broad enough to be coupled any way?

A. As long as the flywheel mass is at the place of control.

XQ. 65. Is it limited to an always constant and regulable average longitudinal speed?

A. Well, it states in the characteristic clause that it is for the purpose of obtaining an always constant and adjustable medium longitudinal speed.

Q. 66. Do you interpret that that way? My translation says a regulable average.

A. I suppose that would be more correct translation, regulable average.

XQ. 67. Now, in connection with that claim, will you look at the specification. Do you find reference there to not only regulable average, but also a momentary absolute constant speed?

A. May I look at the original?

XQ. 68. Yes.

A. It says here it insures directly at the control place, both a controllable average and also an instanta-

neous absolutely constant propulsion velocity of the phonogram carrier.

XQ. 69. Will you turn to the last paragraph before the claim, where reference is made to revoluton counter and speed governor which, by their action on the drive motor, maintain the average speed of reproduction? Do you find that?

A. Yes, it says here that the axis of the roller r_2 or m, which I understand refers to the flywheel, is furthermore connected with a revolution counter and speed governor not shown in the drawing, which by acting upon driving motor, maintain the average reproduction speed.

XQ. 70. Is that the regulable average speed that the specification referred to where I referred you before?

A. Well, the specification does not state so. It only says that the speed governor I suppose is mentioned principally, to maintain the average reproduction speed.

XQ. 71. And then in the claim that we were looking at where it refers to the regulable average speed. Is that the regulable speed produced by the governor?

A. The claim does not state that. The claim states that the phonogram carrier is coupled with a rotatable centrifugal mass in order to obtain an always constant —it says here—controllable mean longitudinal speed.

XQ. 72. The claim is not limited to any sprocket gear for moving the film, is it?

A. The claim does not mention any particular means.

XQ. 73. And the claim is not limited to any particular arrangement or connection of the flywheel with the roller or means that touches the film, is it?

A. No, the claim merely states, as I said before, that the flywheel mass or centrifugal mass is coupled with the phonogram carrier at the place of control.

RE-DIRECT EXAMINATION.

By MR. ASHTON:

RDQ. 74. When Mr. Ward asked you about filing more than one application in the United States, with respect to corresponding German applications, you did not mean to state that such applications if filed would be valid if they were not filed in time, did you?

A. No, they certainly could not be valid if they were not filed in time.

RDQ. 75. State briefly whether or not this Claim 1 or German Patent No. 387,058, covers broadly in Germany the use of a flywheel in connection with a linear phonogram carrier.

A. Yes. In the application of the claim it covers that broadly.

RE-CROSS-EXAMINATION.

By MR. WARD:

RXQ. 76. Is that an apparatus claim?

A. That is an apparatus claim, yes.

Jermyn Hotel.

MR. WARD: We have met here to give a demonstration to the Court of two Tri-Ergon machines, which will be demonstrated under the direction of Professor Ballard, the expert for the plaintiffs. There are present his Honor, the Judge; and representing the defendants Mr. Neave, Mr. Ashton, Mr. Waterman, Mr. Kellogg, Dr. Wente, in this room; and Mr. Hasleton, Dr. Engl, Professor Ballard and myself. In the other room, where the two machines will be run, there are present representing the defendants Mr. Keller and Mr. Kreuzer; and the staff of operators in charge of the machines for the plaintiffs.

Now, I suggest that during the demonstration Professor Ballard will take charge and state first

the object of the demonstration and, after he has stated the object of the demonstration, the machines will be started and he will describe the subjects and what they are. And in the course of the reproduction he may make some remarks with regard to it.

And, as in the case of the other demonstration, given by the defendants, I suggest that as much as possible of the cross-examination be left until we meet in the court house.

After the demonstration we would like to have the Court go in the other room and examine the two machines.

And after that we shall be glad to have an informal inspection of the machines by the representatives of the defendants.

Professor, will you go ahead and start the demonstration.

TRI-ERGON DEMONSTRATION
Scranton, Pa.

JERMYN HOTEL
June 22, 1933

Machine Type
Tri-Ergon Machine
(Figs. 5 and 6 of patent in suit)

Subject

1 West Point (recorded March 1927 with glow light)
2 Fountains Of Rome (with music)
3. Piano selection from Rachmaninoff Prelude C Minor (Glow light recording)

4. Frequency Test
   100 :
   200 :
   500 :
   1000 : Cycles
   2000 : Glow light
   3000 : recording
   4000 :
   5000

Part 2
Tri-Ergon machine
(Fig. 2 of pat. in suit)

Talk

1. Admiral Beatty (recorded in England 1928 with glow light)
2. Piano selection (same as No. 3)
3. Frequency Test (Same as No. 4)

WILLIAM C. BALLARD, resumed:

THE WITNESS: May it please your Honor, the defendants in their testimony, have attacked the operativeness of the patents on several alleged grounds.

They have asserted in substance that one reason for the inoperativeness of such structures as involve one or more springs in a flywheel is that "any mechanical system which consists of a mass and a spring is what is known as an oscillatory system," and that because of this principle, such a construction with the undamped spring between the driving shaft and the flywheel is very much worse than without any spring, and is entirely

inoperative for commercial sound recording and reproduction.

They have further stated in substance that in the structure of such figures as are represented by 5 and 6 and 3 and 4, where pressure rollers press the film down upon the film driving sprocket at points spaced on each side of the translation point where the light is projected on the film, a portion of the film between these pressure rollers will rise and fall or flop up and down on the surface of the sprocket, thereby throwing the sound track out of focus, resulting in imperfect sound reproduction.

They state that the film operated in this manner in their demonstrations of the alleged models representing these figures of the patent in suit, and that in order to obviate this it is necessary to place a small shoe pressing the film down on the sprocket roller at or near the translation point.

The purpose of some of the tests tonight is to show that a machine having the criticized construction, that is, the undamped spring between the driving shaft and the flywheel, and having the pressure rollers located as shown in Figure 3, without any shoe, gives entirely satisfactory sound reproduction.

The first test will be made on a machine embodying this construction. The machine used is one of Dr. Engl's Tri-Ergon machines which he has testified was one of a lot of twenty-five built in Germany in about 1924 to 1925, and which is shown in the photographs already put in evidence as Exhibits 23 and 24, with the exception that the film driving sprocket and shaft which the testimony shows was formerly in that machine has been removed and a new sprocket of the same

size with its shaft has been substituted for the original one which had become badly worn.

In the new sprocket the outer idling ring that was formerly in the machine carrying the second row of sprockets has been omitted and in this respect the new sprocket conforms to the type of sprocket used by the defendants in their construction. The connection is——

MR. WARD: May I interrupt you. That is in their construction of the model they built to show the demonstration of these same figures of the patent?

THE WITNESS: Yes.

The connection between the driving shaft and the flywheel, including the undamped spring, are the same in size as in the machine formerly. The spring is the same one as is described in the patent in suit and has no special damping means such as defendants' testimony claims was necessary to make the machine operative.

Furthermore, the machine has two pressure rollers pressing the film down on the sprocket which the patent calls for and which have been spaced apart with the same relationship to the roller as shown in the patent, but there is no shoe present, as defendants' testimony claims must be present in order to give performance.

The numbers played in the first test will be continuously presented and, in order not to interrupt the performance, I should like to just make a few remarks:

The first number, which you will see headed as "West Point," is one of the earliest, if not the earliest, outdoor recordings in the United States, as far as my knowledge extends. It was recorded with apparatus hastily gotten together

and mounted on a truck and sent up to West Point in the early part of 1927. And I am sorry that you can't see the pictures, because I really think the pictures are quite interesting.

The talk is given by the Commandant at the Point.

MR. WARD: What is No. 1 recorded with: what was that?

THE WITNESS: It is recorded as noted on the program, with a glow light.

No. 2 is merely incidental music in connection with some very beautiful pictures taken of the scenery in Rome.

No. 3 is a special piano recording of the Rachmaninoff Prelude in C-sharp minor. This was selected on account of the sustaining tones which you will hear, and this record has been used to a considerable extent in testing speed fluctuations.

MR. WARD: Is that piano record characteristic of one having the long sustained tones as contrasted with quick music?

THE WITNESS: Yes, as I tried to point out a moment ago.

The last part of the film is merely a series of tones, starting out with 100 cycles, 200, 500, 1,000, 2,000, 3,000, 4,000 and 5,000, recorded with glow light recording.

Now, if you are ready.

(Demonstration of "West Point.")

THE WITNESS: As you notice, this is an old film and there are one or two splices that come through the film as clicks.

(No. 2, "Fountains of Rome," demonstration.)

THE WITNESS: Will you have him touch the flywheel; see how it changes.

MR. WARD: Have him touch the flywheel to make it oscillate.

Do you hear it oscillating, Professor Ballard?

THE WITNESS: It is oscillating now—it is damped out in three or four cycles at the most.

MR. WARD: Have the oscillations now ceased?

THE WITNESS: The oscillations have now ceased, yes, sir.

MR. WARD: Professor Ballard, will you state your observation of that before the next is played?

THE WITNESS: I note that there are one or two places where there are joints which come through, one place where a part of the film had been actually removed, missing, we lost a few notes there.

So far, I think this to my ear sounds to be good commercial reproduction, considering that the films are rather old, recorded many years old.

(No. 3, Rachmaninoff demonstration, piano.)

THE WITNESS: If you will listen for the waiver in the sustained tone, which would readily indicate speed fluctuations, you will find they are absent.

MR. WARD: Professor Ballard, comment on that after the next one is played, so as not to be interrupted.

And you tell them about holding their heads still now, for this.

THE WITNESS: Yes. The same instructions that were given you at the previous demonstration, of course, apply with this last frequency test.

Please do not move your heads, because in moving it will indicate a change in volume.

(Test No. 4 started.)

MR. WARD: This is 200 cycles, is it not?

THE WITNESS: 200.

(Demonstration continued.)

MR. WARD: 1,000 next. 2,000. 3,000. 4,000. 5,000.

(Demonstration ended.)

THE WITNESS: There are other higher pitches actually on that record, but so many people cannot hear them that we cut them off at 5,000.

MR. WARD: Now, will you comment, Professor Ballard, on the piano rendition, while they are changing over to the other.

THE WITNESS: The sustained tones in the piano rendition, No. 3 of this test, were to my ear quite sustained and free from irregularities, indicating good speed regulation.

MR. WARD: Have you heard that piano record played elsewhere, in other machines?

THE WITNESS: I have.

MR. WARD: Commercially?

THE WITNESS: I have.

MR. WARD: In some theaters; and, if so, do you know where?

THE WITNESS: No, in no theater. I have heard it at other places.

MR. WARD: And how does this performance compare with that?

THE WITNESS: It is quite equal, if not better.

MR. WARD: Now what do you say as to the frequency test?

THE WITNESS: The frequency test, while not absolutely perfect—there was some irregularity in the recording of this record—I think it was sufficiently close so that no normal ear will be bothered by any speed variations, as indicated in the No. 4 frequency test. I think that was brought out quite clearly in Selection No. 3.

It will be necessary to wait a few moments before the next part can be put on, because we have to remove one German head and replace it with another one.

We will now run one of the other German sound heads, which the testimony will show is in this group of twenty-five, as was the first machine we have already run, except that in this machine the sprocket flywheel and spring drive of Figures 3 to 6 of the patent have been removed and the movement of the Figure 2 of the patent has been substituted, wherein the film passes over one sprocket which feeds the film to a smooth roller over a substantial portion of the periphery of which the film passes in contact past the translation point, and thence to a second sprocket which feeds the film off the smooth roller. Two spring-pressed rollers press upon the film, one between the first sprocket and the smooth roller, and one between the smooth roller and the second sprocket, as actually shown in Figure 2 of the patent.

This machine is in the condition and of the same construction as shown in the photographs, Exhibits 29, 30 and 31.

The program to be run on this machine, in order to give you an opportunity to compare the two tests, is in part the same as you have heard

on the first machine, with the exception that in order not to tire you we have substituted a different one in Talk No. 1.

The first one is a talk made by Admiral Beatty. It was recorded in England in 1928 with a glow light in one of the portable pickup recording equipments.

MR. WARD: It was addressed to part of the American Legion over there?

THE WITNESS: I think it is. The No. 2, piano selection, is the same as you heard under No. 3 in the first test, and the frequency test is as under No. 4 in the first group.

I will have to ask your indulgence while they move the machine. They have to take out a few bolts and put the other head on and connect it up.

(Test No. 1, Part 2, Admiral Beatty talk.)

THE WITNESS: They had trouble with recording this. There is a rooster in the background trying to make himself heard.

(Test No. 2, Part 2, piano selection.)

MR. WARD: What is this, Professor?

THE WITNESS: This is the same piano record that you heard a moment ago, played on both machines to give you an idea of the comparison between these two machines.

The last part is a repetition of Part 4 of the first series of tests. You will hear the same frequencies, and I ask you, in order to judge them, not to move your head while you are listening.

(Cycles demonstration.)

MR. WARD: Professor, I heard an interruption when the signal was given, that first low note. Will you state what caused that?

THE WITNESS: They were changing the volume, changing the volume in the other room there, which caused an interruption, a break in the loudness of the signal.

MR. WARD: Now will you comment just very briefly on the three selections—very briefly—and finish up in court tomorrow.

THE WITNESS: For the purpose of the record I should like to say that to my ear the talk of Admiral Beatty was quite understandable. It showed not the slightest indication of any speed fluctuations. And I thought it was very good.

The No. 2, piano selection, had, if anything, better quality than in the first reproduction. There was no noticeable speed fluctuation or hunting, or anything of that character, to my mind.

The frequency test seemed to me to be slightly smoother in this reproduction than in the No. 4 of the first test, as we should naturally expect it, from the construction of the machine.

Unless your Honor wishes to have additional records played, this will conclude our demonstration.

MR. WARD: Your Honor, we have the defendants' records, or one or two of them, brought here; but Professor Ballard testified that the music we played was the most severe test, and the frequency range we have given several more than they gave.

So unless your Honor would care to hear it, by comparison, I think this will do to establish our purpose.

Would your Honor like to come in and take a look at these machines?

THE COURT: I will look at them briefly.

MR. ASHTON: I offer in evidence File Wrapper and Contents of Edison Patent No. 227,679, granted May 18, 1880, and ask that the same be marked Defendants' Exhibit 73.

MR. WARD: Objected to upon the ground that the File Wrapper and Contents constitute no part of the state of the prior art, but are merely documents in the United States Patent Office; does not constitute a prior patent or publication, and is therefore irrelevant and immaterial.

THE COURT: Overruled for the present, to be reconsidered later.

(Same received in evidence and marked Defendants' Exhibit 73.)

MR. ASHTON: I offer in evidence Defendants' Prior Art Book No. 1, containing the following prior art patents and publications, and ask that the same be marked Defendants' Exhibit 74:

UNITED STATES PATENTS.			ITEM NO.
200,521	Edison	Feb. 19, 1878	1
210,249	Gally	Nov. 26, 1878	2
227,679	Edison	May 18, 1880	3
341,213	Bell & Tainter	May 4, 1886	4
341,214	Bell & Tainter	May 4, 1886	5
341,288	Tainter	May 4, 1886	6
386,974	Edison	July 31, 1888	7
499,879	Edison	June 20, 1893	8
513,095	Edison	Jan. 23, 1894	9
534,543	Berliner	Feb. 19, 1895	10
551,946	Cooley	Dec. 24, 1895	11
587,527	Holst	Aug. 3, 1897	12
597,875	Clark	Jan. 25, 1898	13
602,453	Jones	Apr. 19, 1898	14
605,484	Jones	June 14, 1898	15

	UNITED STATES PATENTS.		ITEM No.
724,645	Wood	Apr. 7, 1903	16
995,390	Underhill	June 13, 1911	17
1,065,576	Amet	June 24, 1913	18
1,085,443	Lanchester	Jan. 27, 1914	19
1,162,433	Amet	Nov. 30, 1915	20
1,203,190	Fritts	Oct. 31, 1916	21
1,221,407	Amet	Apr. 3, 1917	22
1,255,143	Ebeling	Feb. 5, 1918	23
1,355,523	Arthur	Oct. 12, 1920	24
1,367,863	Clark	Feb. 8, 1921	25
1,388,515	Clark	Aug. 23, 1921	26
1,425,177	Constable	Aug. 8, 1922	27
1,447,913	Trowbridge et al.	Mar. 6, 1923	28
1,473,976	Ries	Nov. 13, 1923	29
1,607,480	Ries	Nov. 10, 1926	30
1,710,677	Cawley	Apr. 23, 1929	31
1,825,438	Cawley	Sept. 29, 1931	32
1,825,439	Cawley	Sept. 29, 1931	33
1,825,440	Cawley	Sept. 29, 1931	34
1,825,441	Cawley	Sept. 29, 1931	35
1,878,577	Cawley	Sept. 20, 1932	36

	BRITISH PATENTS.		
1,644	Edison	of 1878	37
2,814	Jamieson et al.	of 1884	38
21,371	Baron	of 1898	39
24,546	Duddell	of 1902	40
15,333	Royce	of 1912	41
115,942	Pedersen	of 1918	42

	FRENCH PATENTS.		
393,301	Fabbrica etc. Parlate	1908	43
10,377	Fabbrica etc. Parlate	1909	44
414,788	Comp. Gen. de Phon.	1910	45
472,467	Dragoumis	1914	46

PUBLICATIONS.

Scientific American, June 18, 1881, page 394		47
Proceedings of the Physical Society, Vol. XXXII, 1920, pages 78 to 81, inclusive		48

GERMAN PATENT.

141,634	Kher	1903	49

MR. WARD: All of the items of Defendants' Exhibit 74, commencing with and including Item 24, the Arthur patent, down through and including Cawley Patent No. 1,878,577 (Item 36), are objected to upon the ground that they issued or were granted too late to constitute evidence of the state of the prior art.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibit 74.)

IT IS STIPULATED AND AGREED by and between counsel for the parties hereto that the Proceedings of the Physical Society, Volume XXXII, 1920, pages 78 to 81 inclusive, containing the article by Rankine, entitled "On Recording and Reproducing Sound by Means of Light," Defendants' Exhibit 74, Item 48, were published in 1920 and a copy was received by the Engineering Society's library, New York City, on March 24th, 1920.

MR. ASHTON: This information we received yesterday by telephone and is subject to correction, if error appears; and defendant reserves the right until the close of the trial to obtain evidence of other copies having been received by other libraries in this country.

Mr. Ward: Plaintiffs reserve objection to this Item 48 of Defendants' Exhibit 74 in the event that it is ascertained that the date of March 24th, 1920, is not accurate.

Mr. Ashton: I offer in evidence Defendants' Prior Art Book No. 2, containing the following patents and publications, and ask that the same be marked Defendants' Exhibit 75:

	United States Patents.		Item No.
299,013	Robb	May 20, 1884	1
364,472	Bock	June 7, 1887	2
458,916	Oxley	Sept. 1, 1891	3
502,382	Randall	Aug. 1, 1893	4
565,657	Ader	Aug. 11, 1896	5
691,667	Rowland	Jan. 21, 1902	6
939,692	Holman	Nov. 9, 1909	7
1,075,692	Cannock	Oct. 14, 1913	8
1,135,436	Chabeault	Apr. 13, 1915	9
1,165,629	Schneider	Dec. 28, 1915	10
1,186,069	Blair	June 6, 1916	11
1,186,982	Hall	June 13, 1916	12
1,246,217	Anderson	Nov. 13, 1917	13
1,256,613	Terwilliger	Feb. 19, 1918	14
1,261,797	Ebeling	Apr. 9, 1918	15
1,273,328	Cameron	July 23, 1918	16
1,273,627	Langmuir	July 23, 1918	17
1,317,450	Momyer	Sept. 30, 1919	18
1,366,446	Collins	Jan. 25, 1921	19
1,381,474	Kunz	June 14, 1921	20
1,567,424	Compton	Dec. 29, 1925	21

Publications.

The Electrical Journal, Volume XI, No. 5, May, 1914, pages 262 and 263	22
Physical Review, Volume 10, No. 2, August, 1917, pages 205 and 206	23

MR. WARD: We object to Items 19, 20 and 21, *i. e.*, the Collins Patent No. 1,366,446, the Kunz Patent No. 1,381,474, and the Compton Patent No. 1,567,424, on the ground that they issued too late to be any evidence of the state of the prior art.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibit 75.)

MR. ASHTON: I offer in evidence the following apparatus used in defendants' demonstration at the Jermyn Hotel on June 20th, 1933:

Defendants' alleged infringing apparatus PS1, including the turntable and stand, as Defendants' Exhibit 76 (physical); photograph of Defendants' Exhibit 76 to be marked Defendants' Exhibit 76-A. The machine Defendants' Exhibit 76 being the machine in the foreground of the photograph.

MR. WARD: That part of the machine involving the so-called turntable is objected to as irrelevant and immaterial and having nothing to do with the subject matter of the suit.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibits 76 and 76-A respectively.)

MR. ASHTON: I offer in evidence defendants' alleged infringing apparatus PS16, as Defendants' Exhibit 77 (physical), and photograph of Defendants' Exhibit 77, to be marked as Defendants' Exhibit 77-A.

(Received and marked Defendants' Exhibits 77 and 77-A respectively.)

MR. ASHTON: I offer in evidence Defendants' Model of Figure 1 of Vogt, Massolle and Engl German Patent No. 387,058, applied for May 23d, 1920, as Defendants' Exhibit 78 (physical), and three photographs of Defendants' Exhibit 78 to be marked Defendants' Exhibits 78-A, 78-B and 78-C, respectively.

MR. WARD: The model, Exhibit 78, as well as the photographs 78-A, 78-B and 78-C, are objected to upon the ground that they do not illustrate the construction or teaching of the said German Patent No. 387,058, but are a different structure and operate in a different manner.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibits 78, 78-A, 78-B, 78-C, respectively.)

MR. ASHTON: I offer in evidence Defendants' model of Figure 5 of the patent in suit as Defendants' Exhibit 79 (physical), and three photographs to be marked Defendants' Exhibits 79-A, 79-B and 79-C, respectively.

(Note: Photograph Defendants' Exhibit 79-C to be retaken so that the shoe located on the door at the right of the photograph above the photo-electric cell when the machine was used in the defendants' demonstration shall appear.)

MR. WARD: I understand that this shoe is the one which was said to have pressed upon the film supporting and driving roller, which is not shown now in the photograph 79-C, and that that is the shoe which will be shown in the new photograph.

MR. WARD: Now I object to the model and to the photographs of the same, upon the ground that

they do not properly illustrate the structure of the patent in suit which they purport to illustrate.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibits 79, 79-A, 79-B and 79-C, respectively.)

MR. ASHTON: I offer in evidence defendants' model machine in which Exhibits 78 and 79 were demonstrated, said model machine to be marked Defendants' Exhibit 80 (physical). Photograph of this machine Exhibit 80 to be marked Defendants' Exhibit 80-A, this photograph to be taken today and marked when the trial resumes, a copy to be furnished to plaintiffs' counsel on Monday.

MR. WARD: No objection, provided counsel is furnished with a copy of the photograph by Monday noon.

(Received and marked Defendants' Exhibits 80 and 80-A.)

MR. ASHTON: I offer in evidence defendants' model of the Amet drive, as demonstrated in place of the spring drive of Figure 5 of the patent in suit, to be marked Defendants' Exhibit 81 (physical). Photograph of the said exhibit is offered in evidence, to be marked Defendants' Exhibit 81-A.

MR. WARD: I understand that this Exhibit 81 with the photograph of the same is not the model and photograph of the Amet machine, but is the alleged model of Figures 5 and 6 of the patent in suit, with the Amet drive substituted for the spring drive of the patent. Is that correct, Mr. Ashton?

MR. ASHTON: Yes.

MR. WARD: I object to Exhibit 81 and photograph of the same, Exhibit 81-A, on the ground that the model does not properly demonstrate the structure of the patent in suit, and that the drive therein is not the proper embodiment of the Amet drive, and that the exhibits are irrelevant and immaterial to the subject matter.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibits 81 and 81-A.)

MR. ASHTON: I offer in evidence Defendants' model of the spring drive of the Constable prior art Patent No. 1,425,177, as demonstrated, in place of the spring drive of Figure 5 of the patent in suit, as Defendants' Exhibit 82 (physical). Photograph of Defendants' Exhibit 82 to be marked Defendants' Exhibit 82-A. This is the same model referred to previously with respect to Defendants' Exhibit 81 and in which the Constable spring drive has been substituted for the Amet coupling.

MR. WARD: Same objection as to Exhibit 81.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibits 82 and 82-A.)

MR. ASHTON: I offer in evidence defendants' model of the machine of the Constable prior art Patent No. 1,425,177, as Defendants' Exhibit 83 (physical). Three photographs of Defendants' Exhibit 83 to be marked Defendants' Exhibits 83-A, 83-B and 83-C, respectively.

MR. WARD: I object to the model and the photographs on the ground that they are in no sense a

reproduction of the structure shown and described in the Constable patent which they purport to illustrate, being constructed and operated entirely differently; and I particularly call attention to the long reproducing pickup arm extending from the support on top of the box in the foreground over to the record, in lieu of the character of reproduction apparatus that the patent illustrates.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibits 83, 83-A, 83-B and 83-C, respectively.)

MR. WARD: Do I understand that the physical exhibit would include this long arm?

MR. ASHTON: No, it will not. Defendant agrees to produce the electric pickup shown in the photograph Exhibit 83-A and which was used at the demonstration, at any time upon request, for inspection by the plaintiff, in the presence of the representative of the defendant.

MR. WARD: Will you have one of these pickup arms at the argument?

MR. ASHTON: Defendant will produce the pickup arm shown in Exhibit 83-A at the argument.

I offer in evidence Defendants' model referred to as the Edison Skeleton model, as Defendants' Exhibit 84 (physical). A photograph of Exhibit 84 to be marked as Defendants' Exhibit 84-A.

MR. WARD: I understood from Mr. Waterman's testimony, as I recall it, that this machine was intended to show some reconstructed or rearranged parts of the Edison Triumph with the cylinder mandrel, or mandrel equipped with a sprocket, to show how stylus-made sound on film

record could be run on this machine. I object to the model and the photograph as illustrating nothing in the prior art, and as a device merely being made up from parts disclosed in different prior art structures, only a few of which existed at the time of the alleged patents or combination of patents which the model is supposed to represent; and further on the ground that it contains none of the various distinguishing features of the different prior art patents, of which it is supposed to be a composite structure; and further on the ground that it has modern electrical pickup and support, as shown by Mr. Waterman's testimony.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibits 84 and 84-A.)

MR. ASHTON: I offer in evidence Defendants' model of the Bell & Tainter prior art Patent No. 341,214, as Defendants' Exhibit 85 (physical). Two photographs of Defendants' Exhibit 85 to be marked Defendants' Exhibits 85-A and 85-B respectively.

MR. WARD: I object to the exhibit and the photographs as not properly illustrating the Bell & Tainter patented structure, which they purport to represent, and I direct the Court's attention to Plaintiffs' Exhibits marked for Identification 41 and 42 respectively, as illustrating the Bell & Tainter model, which was said to be in the Smithsonian Institution.

I also call attention to the electric pickup in the photographs of this exhibit and in the exhibit.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibits 85, 85-A and 85-B, respectively.)

MR. ASHTON: I offer in evidence Defendants' model of French Patent No. 472,467 to Dragoumis et al., as Defendants' Exhibit 86 (physical), and photograph of Defendants' Exhibit 86 to be marked as Defendants' Exhibit 86-A.

MR. WARD: Objected to on the ground that the model and photograph do not illustrate the structure of the patent which they purport to illustrate, and I call particular attention to the fact that a large amount of connected gearing and mechanism which would produce irregular loads in the machine as shown in the patent has been entirely omitted from the model; that the model has a modern electric pickup, and that the sound record is not the character of sound record described in the patent as shown from Mr. Waterman's testimony.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibits 86 and 86-A.)

MR. ASHTON: I offer in evidence Defendants' model referred to as Reel Film Model, as Defendants' Exhibit 87 (physical); photograph of Exhibit 87 to be marked Defendants' Exhibit 87-A.

MR. WARD: I understand from Mr. Waterman's testimony that this machine merely represents a shaft mounted in a bearing, having a large wheel at one end and a film drive and supporting sprocket at the other, using a modern stylus sound record, produced by modern electric methods and with modern electric pickup system, and that the

machine does not illustrate any structure of the prior art. I object to the model as wholly irrelevant and immaterial.

MR. ASHTON: Attention is called to the fact that Mr. Ward stated in his opening statement that mechanical records on film of this type could not be made and were impractical.

MR. WARD: If I recall my statement, it was that I knew of no such records, and I did not believe they could be made, and that statement is correct, as far as my knowledge goes. And it certainly is correct as to the date of the patents that I was talking about. This testimony shows that these records have been made by a system of very recent development which, for my part, I had never heard of or seen until produced at this trial.

MR. ASHTON: Attention is called to Mr. Waterman's testimony with regard to the making of the records.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendant's Exhibits 87 and 87-A.)

MR. ASHTON: I offer in evidence defendants' model of prior art French Patent No. 414,788 to Compagnie de Phonographes et al., as Defendants' Exhibit 88 (physical); and a photograph showing Exhibit 88 at the right, and the Victrola machine Defendants' Exhibit 39 also demonstrated at the left; this photograph to be marked Defendants' Exhibit 88-A.

MR. WARD: I object to the model of Defendants' Exhibit 88 and the photograph of the same,

as not correctly representing the structure of the publication which it is alleged to represent, and I particularly call attention to the testimony about this device having the modern oil-damp pickup arrangement as illustrated in part by the long horizontal pivoted arm, one end of which rests upon the disc on the machine, this being a counterbalanced arm.

And in the picture of the Victrola shown in the photograph 88-A, I also call attention to the same pickup arm as shown, which I have just mentioned, which is shown in place of the regular stylus on that machine as shown in the center of the photograph, and which was not used during the demonstration of this Victrola, but the more modern pickup arm was used in its place.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibits 88 and 88-A.)

MR. ASHTON: I offer in evidence the cylindrical, disc and film records used at the defendants' demonstration and ask that they be marked Defendants' Exhibits 89-A to 89-K, respectively, as follows:

89-A—Cylindrical record with speech and waltz for Edison Kinetophone (Defts.' Ex. 11).

89-B—Cylindrical record with piano for Edison Kinetophone.

89-C—Cylindrical record with 512 cycles for Edison Kinetophone.

89-D—Cylindrical record with speech, waltz and piano for Edison Triumph (Defts.' Ex. 31).

89-E—Cylindrical record with 512 cycles for Edison Triumph.

89-F—Thin cylindrical record with speech for Edison Triumph.

89-G—Thin cylindrical record with waltz for Edison Triumph.

89-H—Film with speech and waltz for Reel Film machine (Defts.' Ex. 87).

89-I—Film loop with waltz for Edison Skeleton machine (Defts.' Ex. 84).

89-J—Film loop with speech and march for Dragoumis machine (Defts.' Ex. 86).

89-K—Victor record with Hungarian Rhapsody for General Phonograph and Victrola (Defts.' Exs. 88 and 39, respectively).

I also offer in evidence a photograph showing all of these records 89-A to 89-Q inclusive, and request that the same be marked Defendants' Exhibit 89-R.

Mr. Ward: I object to all of the cylinder record Exhibits 89-A to 89-J inclusive, on the ground that as shown from Mr. Waterman's testimony, they were what is known as soft wax records, made by the most modern equipment and system, on which the records were produced electrically on modern machines, instead of the machines on which they were played, and that the records were of a character which were kept in a refrigerator in the room where they were demonstrated, when not in use.

The method of making the record being not known at the date of the alleged machines on which the records were demonstrated.

Furthermore, the materials of the record are of modern origin, and therefore they serve to illustrate nothing with respect to what could be recorded or reproduced on these early machines prior to the date of the patent in suit. They are

objected to, therefore, as irrelevant and immaterial.

Mr. Ashton: Attention is called to Mr. Waterman's testimony with respect to the making of these cylindrical records. The records are the usual wax type, known for a great many years, and which are required to be kept cold because made of wax.

Mr. Ward: I object to the stylus type of film records, Exhibits 89-K to 89-O inclusive, on the ground that it is shown from the witness Waterman's testimony that they were formed by modern methods on modern machines and not on the machines upon which they were demonstrated; this system of forming such records not existing at the supposed time that the machines which they were used in connection with in the demonstration. They do not give any indication of the character of record which could have been produced on those supposed machines or reproduced from them.

Mr. Ashton: Attention is called to Mr. Waterman's testimony with respect to the making of these records.

Mr. Ward: I object to the record, Item 89-P, as not being one recorded on the machine with which it was used, and on the ground that the character of the record thereon has not been testified to as to how it was made.

The Court: Overruled for the present, to be reconsidered later.

Mr. Ward: And I object to the photograph 89-R of the various records on the same grounds that I object to the records themselves.

THE COURT: Overruled for the present, to be reconsidered later.

(Cylindrical, disc and film records used at defendants' demonstration received and marked Defendants' Exhibits 89-A to 89-K inclusive.)

(Photograph of same received and marked Defendants' Exhibit 89-R.)

MR. ASHTON: I offer in evidence photograph of Edison Kinetophone as demonstrated with mechanical reproduction, as Defendants' Exhibit 89-S, the Edison Kinetophone itself being Defendants' Exhibit 11. The Kinetophone shown in the photograph is the machine to which the horn is attached.

MR. WARD: This photograph of Exhibit 89-S is objected to on the ground that the existence of the machine which it purports to show has, in my opinion, not been established to have existed at the date alleged on it, in the same construction as shown in this photograph.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibit 89-S.)

MR. ASHTON: I offer in evidence photograph of Edison Kinetophone, Defendants' Exhibit 11, as demonstrated, with electrical reproduction, and ask that it be marked Defendants' Exhibit 89-T.

MR. WARD: I call attention to the fact that although this machine shows an older type of stylus at the very top of the machine, that the testimony shows that this was not used in the demonstration of this machine, but instead the modern electric pickup indicated by the long black

featherweight lever shows at the left of the photograph, with electric pickup system, that that was used instead, and that the synchronizing belt which the testimony shows was used at the time the Edison Kinetoscopes were used and running from the Kinetoscope through the auditorium to the motion picture machine and back again, was omitted in the demonstration, and is omitted on this photograph of the machine as demonstrated. For these reasons I object to the photograph as not representing the Edison Kinetophone as it existed and was used, the results obtained from the demonstration of this machine as shown in the photograph being no indication of the character of the performance of said machine.

Mr. Ashton: Attention is called to the testimony of defendants' witnesses with respect to the machine, Defendants' Exhibit 11, and also its use as demonstrated.

The Court: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibit 89-T.)

Mr. Ashton: I offer in evidence photograph of the Edison Triumph Machine as demonstrated with electrical reproduction, and ask that it be marked as Defendants' Exhibit 89-U. The machine referred to being the machine in the foreground of the photograph.

Mr. Ward: I object to this photograph for the same reasons as stated in the last objection as to Exhibit 89-T, calling attention to the fact that none of the feed screw apparatus shown in the photograph, nor the old stylus system for recording were used, according to Mr. Waterman's own testimony in the demonstration.

MR. ASHTON: The Edison Triumph machine is Defendants' Exhibit 31. Attention is called to the testimony of defendants' witnesses as to this machine and its demonstration.

MR. WARD: And I further call the Court's attention to the crude casting structure shown on the left-hand side of this machine for supporting the flywheel and to the inconsistency with that structure and the presence of that flywheel, as contrasted with the pages in the Edison Phonograph booklet marked for identification as Plaintiffs' Exhibit 43.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibit 89-U.)

MR. ASHTON: I offer in evidence photograph of the Hoxie Reproducer, Defendants' Exhibit 45, as operated at defendants' demonstration, and ask that the same be marked Defendants' Exhibit 89-V.

MR. WARD: I have no objection to the photograph as correctly showing the machine as produced in evidence; and so far as the photograph goes, but I direct the Court's attention to the character of the defendants' evidence, seeking to establish the date of this machine.

(Received in evidence and marked Defendants' Exhibit 89-V.)

MR. ASHTON: I offer in evidence photograph of demonstration room in which machines were located at the time of the defendants' demonstration and ask that the same be marked Defendants' Exhibit 89-W.

(Received in evidence and marked Defendants' Exhibit 89-W.)

MR. ASHTON: I offer in evidence photograph of the adjoining room in which reproductions of defendants' demonstrations were heard by the Court and representatives of the parties, and ask that the same be marked Defendants' Exhibit 89-X.

(Received and marked Defendants' Exhibit 89-X.)

MR. ASHTON: I offer in evidence File History, including application as originally filed, of Clark Patents Nos. 1,367,863, granted February 8, 1921, and No. 1,388,515, granted August 23, 1921, and ask that they be marked respectively Defendants' Exhibits 90-A and 90-B, Items 25 and 26 of Defendants' Exhibit 74.

MR. WARD: Objected to in so far as concerns the use of the File Wrappers as having any relevancy in showing the state of the prior art, since the law is that they cannot be used to show the state of the prior art, but only the patent as issued.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibits 90-A and 90-B.)

MR. ASHTON: I offer in evidence File History, including application as originally filed, of Constable Patent No. 1,425,177, granted August 8, 1922, and ask that the same be marked Defendants' Exhibit 91.

MR. WARD: The same objection.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibit 91.)

MR. ASHTON: I offer in evidence application as originally filed of Trowbridge Patent No. 1,447,913, granted March 6, 1923, and ask that the same be marked Defendants' Exhibit 92.

MR. WARD: Same objection.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibit 92.)

MR. ASHTON: I offer in evidence Application as originally filed of Ries Patent No. 1,473,976, granted November 13, 1923, and Ries Patent No. 1,607,480, granted November 16, 1926, both being based upon one application, Serial No. 769,114, dated March 12, 1913, and ask that the same be marked as Defendants' Exhibit 93.

MR. WARD: The same objection.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibit 93.)

MR. ASHTON: I offer in evidence Application as originally filed of Cawley Patent No. 1,710,677, granted April 23d, 1929, and Cawley Patent No. 1,878,577, granted September 20th, 1932, both patents purporting to be based upon the same original application, Serial No. 328,299, filed October 3d, 1919, and ask that the same be marked as Defendants' Exhibit 94.

MR. WARD: The application Exhibit 94, as representing the original application upon which the Patent No. 1,710,677 was granted, is objected to upon the ground that that is not the fact. There is no proof that the application alleged to be a

division of this Exhibit 94, to wit, application No. 328,299, contained the same disclosure as the divisional application No. 126,648, upon which the Patent No. 1,710,677 was granted. At this point, in view of the manner in which the defendant is seeking to rely upon these Cawley patents, it is necessary to point out to the Court the history of this situation.

On October 3d, 1919, this man Cawley filed an application in the Patent Office in which he showed a ridiculous, inoperative structure for the purpose of recording and reproducing sound by a stylus system. In that application he showed the film passing over a film sprocket with the stylus resting on the film where it was on the sprocket. There was no suggestion of any flywheel in the patent, no suggestion of the use of any rotating mass for the purpose of the patent in suit. After the issuance of the patent in suit and after the Radio Corporation of America had acquired these patents or control of them, they began to file divisional applications and write into the then pending applications flywheels and statements about the effect of flywheels and heavy rotating masses, and tried in every possible way to obtain claims along the lines of the claims of the patent in suit.

The Court's attention is particularly invited to this series of Cawley patents and applications and, while the defendant has not put in the histories of these patents, plaintiffs will do so to show the true facts of the situation. A comparison of the Patents No. 1,878,577 with No. 1,710,677 will illustrate the point I am making.

The Court's attention is called to the fact that in the general stipulation on record it is agreed in Paragraph 6-A with respect to dates appearing upon patents or documents that "it

shall not be presumed under this stipulation that the disclosure in any patent as granted is the same as the disclosure in the application for said patent as filed, or the same as the disclosure in any application of which said patent application is claimed to be a division or a continuation."

I placed that exception in the stipulation with special reference to these Cawley patents and applications.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibit 94.)

MR. ASHTON: I offer in evidence application as originally filed of Cawley Patents Nos. 1,825,438 to 1,825,441 inclusive, all granted September 29th, 1931, and all four patents being based upon the same original application Serial No. 435,984, filed January 8th, 1921, and ask that the same be marked Defendants' Exhibit 95.

MR. WARD: The same objection and remarks as with respect to the other Cawley application referred to and marked Defendants' Exhibit 94.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibit 95.)

MR. ASHTON: I offer in evidence the application as originally filed of the Kunz Patent No. 1,381,474, granted June 14th, 1921, and ask that the same be marked as Defendants' Exhibit 96.

MR. WARD: I object to it on the same grounds as to the Cawley patents, and on the ground that it is irrelevant and immaterial.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibit 96.)

MR. ASHTON: I offer in evidence application as originally filed of the Compton Patent No. 1,567,424, granted December 29th, 1925, and ask that the same be marked as Defendants' Exhibit 97.

MR. WARD: The same objection as to the Kunz offer.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibit 97.)

MR. ASHTON: I offer in evidence file history and contents of German Patent No. 387,058, to Vogt, Massolle and Engl, with translation; for the purpose of showing the proceedings in the German Patent Office, and ask that the same be marked as Defendants' Exhibit 98.

MR. WARD: No objection.

(Received in evidence and marked Defendants' Exhibit 98.)

MR. ASHTON: I offer in evidence Nullity Proceedings in the German Patent Office, entitled "Hermann Greiff v. Tri-Ergon Holding A. G. et al., and Electrical Research Products, Inc., v. Tri-Ergon Holding A. G. et al.," with translations, both relating to German Patent No. 387,058, to Vogt, Massolle and Engl, for the purpose of showing the decisions and on what they were based, and ask that the same be marked as Defendants' Exhibit 99.

MR. WARD: No objection.

(Received in evidence and marked Defendants' Exhibit 99.)

MR. ASHTON: I offer in evidence File History of German Patent No. 389,317, to Massolle, Vogt and Engl, with translation, for the purpose of showing the proceedings in the German Patent Office, and ask that the same be marked Defendants' Exhibit 100.

MR. WARD: No objection.

(Received in evidence and marked Defendants' Exhibit 100.)

MR. ASHTON: I offer in evidence Nullity Proceedings in the German Patent Office with respect to German Patent No. 389,317 to Massolle, Vogt and Engl, with translation, for the purpose of showing the decision and on what it was based, and ask that the same be marked as Defendants' Exhibit 101.

MR. WARD: No objection.

(Received in evidence and marked Defendants' Exhibit 101.)

MR. ASHTON: I offer in evidence File History and Contents of German Patent No. 389,318 to Massolle, Vogt and Engl, with translation, for the purpose of showing the proceedings in the German Patent Office, and ask that the same be marked as Defendants' Exhibit 102.

MR. WARD: No objection.

(Received in evidence and marked Defendants' Exhibit 102.)

MR. ASHTON: I offer in evidence Nullity Proceedings in the German Patent Office with respect

to German Patent No. 389,318, with translation, to Massolle, Vogt and Engl, for the purpose of showing the decision and on what it was based, and ask that the same be marked as Defendants' Exhibit 103.

(Received in evidence and marked Defendants' Exhibit 103.)

Mr. Ashton: I offer in evidence File History of German Patent No. 389,319, to Massolle, Vogt and Engl, with translation, for the purpose of showing the proceedings in the German Patent Office, and ask that the same be marked as Defendants' Exhibit 104.)

(Received in evidence and marked Defendants' Exhibit 104.)

Mr. Ashton: I offer in evidence Nullity Proceedings in the German Patent Office with respect to German Patent No. 389,319, to Massolle, Vogt and Engl, with translation, for the purpose of showing the decision and upon what it was based, and ask that the same be marked as Defendants' Exhibit 105.

(Received in evidence and marked Defendants' Exhibit 105.)

Mr. Ashton: I offer in evidence German Patent No. 387,058, to Vogt, Massolle and Engl, with translation, and ask that the same be marked as Defendants' Exhibit 106.

(Received in evidence and marked Defendants' Exhibit 106.)

Mr. Ashton: I offer in evidence German Patent No. 389,317, to Massolle, Vogt and Engl, with translation, and ask that the same be marked as Defendants' Exhibit 107.

(Received in evidence and marked Defendants' Exhibit 107.)

MR. ASHTON: I offer in evidence German Patent No. 389,318, to Massolle, Vogt and Engl, with translation, and ask that the same be marked as Defendants' Exhibit 108.

(Received in evidence and marked Defendants' Exhibit 108.)

MR. ASHTON: I offer in evidence German Patent No. 389,319, to Massolle, Vogt and Engl, with translation, and ask that the same be marked as Defendants' Exhibit 109.

(Received in evidence and marked Defendants' Exhibit 109.)

MR. ASHTON: I offer in evidence British Patent No. 178,133, to Massolle, Vogt and Engl, accepted January 4, 1923, and ask that the same be marked as Defendants' Exhibit 110.

(Received in evidence and marked Defendants' Exhibit 110.)

MR. ASHTON: I offer in evidence certificate of the British Patent Office, containing application as open to public inspection, of British Patent No. 178,133, to Massolle, Vogt and Engl; corresponding application as originally filed in Germany, and translation, and assignment August 16th, 1924, from the patentees to Tri-Ergon A. G. Zurich, and ask that the same be marked Defendants' Exhibit 111.

MR. WARD: I object to the exhibit as not being a complete history of the application in the British Patent Office, but merely parts of the same; and objected to furthermore in so far as there is any reliance, if any, put upon the fact that there was "Public Inspection" of it in the British Patent

Office, if it is used or sought to be used in any way as showing the state of the art.

Mr. Ashton: It is stated that the exhibit contains all papers relating to the prosecuting of the British Patent No. 178,133, which are available to the public under the British law and practice.

Mr. Ward: That does not make it any the less fragmentary as far as concerns what happened to the application in the British Patent Office.

The Court: Overruled for the present, to be reconsidered later.

(British Patent Office certificate, containing application as open to public inspection of British Patent No. 178,133, to Massolle, Vogt and Engl; corresponding to application as originally filed in Germany and translation, and assignment of August 16, 1924, from patentees to Tri-Ergon A. G. Zurich, received in evidence and marked Defendants' Exhibit 111.)

Mr. Ashton: I offer in evidence German Patent No. 417,967, to Vogt, Engl and Massolle, filed March 14, 1919, granted August 22, 1925, with translation, and ask that the same be marked as Defendants' Exhibit 112.

(Received in evidence and marked Defendants' Exhibit 112.)

Mr. Ashton: I offer in evidence two Nullity decisions of the German Patent Office with respect to German Patent No. 417,967, to Vogt, Engl and Massolle, with translations, for the purpose of showing the decisions and upon what they were based, and ask that the same be marked as Defendants' Exhibits 113-A and 113-B respectively.

Mr. Ward: In connection with this patent Exhibit 112, and the Nullity Proceedings 113-A and

113-B, I call the Court's attention to the fact that the claimed subject matter or claims of the German patent are not the same as the claims of Vogt et al. U. S. application for the use of the PE cell for sound recording broadly, and are not the same as the combination claims of the patent in suit on the PE cell in combination with other features.

(Two Nullity decisions of German Patent Office re German Patent No. 417,967, to Vogt, Engl and Massolle, with translations, received in evidence and marked Defendants' Exhibits 113-A and 113-B.)

AFTERNOON SESSION.

Mr. Ashton: I offer in evidence Certificate of the Smithsonian Institution, that machine known as "Berliner Gramophone with Clark's Improvement, Museum No. 253,757," was received by the Smithsonian Institution on April 6th, 1909; machine known as "Berliner Gramophone, Museum No. 307,204," was received by the Smithsonian Institution on January 14th, 1921; that machine known as "Bell & Tainter Machine, Museum No. 287,660," was received by the Smithsonian Institution November 30th, 1920; that "Bell & Tainter Machine, Museum No. 287,653," was received by the Smithsonian Institution November 30th, 1920, and ask that the same be marked as Defendants' Exhibit 114.

Mr. Ward: The certificate is objected to upon the ground that it does not show anything as to whether the machines may not have been withdrawn and altered since received by the Institute, so far as concerns their present condition. This objection will be withdrawn with respect to all of

the machines except the Berliner Gramophone with Clark's improvement, upon presentation of an affidavit from Dr. Mitman of the said Institute that said machines have not been withdrawn from the Smithsonian Institute since they were received and are now in the condition in which they were received.

THE COURT: Overruled for the present, to be reconsidered later.

(Certificate of Smithsonian Institution received in evidence and marked Defendants' Exhibit 114.)

MR. ASHTON: I offer in evidence certificate and three photographs of the machine known as "Berliner Gramophone with Clark's Improvement, Museum No. 253,757," received by the Smithsonian Institution on April 6th, 1909, and ask that the same be marked as Defendants' Exhibits 115-A, 115-B, 115-C and 115-D.

MR. WARD: I object to these photographs for the reason stated in the objection to the certificate above, namely, that they do not establish that the machine at any time prior to the time these photographs were taken were in the condition as shown in these photographs. Of my own knowledge and from actual past experience I have known that privately owned machines filed in the Smithsonian Institution have been withdrawn and altered very materially and put back, and that the officials of the Smithsonian Institute did not know of these changes when the machine was put back.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibits 115-A, 115-B, 115-C and 115-D.)

MR. ASHTON: I offer in evidence certificate and three photographs of the machine known as "Berliner Gramophone, Museum No. 307,204," received by the Smithsonian Institution on January 14th, 1921, and ask that the same be marked as Defendants' Exhibits 116-A, 116-B, 116-C and 116-D.

MR. WARD: Same objection.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibits 116-A, 116-B, 116-C, and 116-D.)

MR. ASHTON: I offer in evidence certificate and three photographs of the machine known as "Bell & Tainter Machine, Museum No. 287,660," received by the Smithsonian Institution November 30th, 1920, and ask that the same be marked as Defendants' Exhibits 117-A, 117-B, 117-C and 117-D, respectively.

MR. WARD: Same objection as with respect to the certificate referring to this machine. The photograph is objected to upon the ground that it does not show sufficient as to the construction and operation of the machine and the type of record used thereon. We are advised from an interview by Mr. Haselton with Dr. Mitman that the reels of this machine are made of paper; that the dimensions of the alleged record strip are as follows: width of strip, slightly less than .2 inch; thickness of strip at the middle, .029 of an inch; thickness of strip near its edge, .015 of an inch; and the strip appears substantially flat on the side away from the stylus, and convex on the side toward the stylus. The strip also appears to be made of a relatively stiff wax material. The measurements given were made by Dr. Mitman.

We ask that the above facts be included in the affidavit to be submitted by him with respect to the certificate, if correct.

MR. ASHTON: And if not correct, Dr. Mitman to make an accurate description of the record.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibits 117-A, 117-B, 117-C and 117-D.)

MR. ASHTON: I offer in evidence certificate and three photographs of the machine known as "Bell & Tainter Machine, Museum No. 287,653," received by the Smithsonian Institution November 30th, 1920, and ask that the same be marked as Defendants' Exhibits 118-A, 118-B, 118-C and 118-D, respectively.

(Received in evidence and marked Defendants' Exhibits 118-A, 118-B, 118-C, 118-D.)

MR. ASHTON: I offer in evidence certificate of the Smithsonian Institution, consisting of four sheets, showing the receipt by it of "Instruction for the Management and Operation of Edison's Speaking Phonograph," and ask that the same be marked as Defendants' Exhibits 119-A, 119-B, 119-C and 119-D, respectively.)

(Received in evidence and marked Defendants' Exhibits 119-A, 119-B, 119-C and 119-D.)

MR. ASHTON: I offer in evidence certificate of Smithsonian Institution certifying copy of the above "Instructions," etc., and ask that the same be marked as Defendants' Exhibits 120-A and 120-B.

(Received in evidence and marked Defendants' Exhibits 120-A and 120-B.)

MR. ASHTON: I offer in evidence separate film gate of Defendants' Machine PS1, and ask that the same be marked as Defendants' Exhibit 121 (physical).

(Received in evidence and marked Defendants' Exhibit 121.)

MR. ASHTON: I offer in evidence separate flywheel assembly of Defendants' Machine PS1, and ask that the same be marked Defendants' Exhibit 122 (physical).

(Received in evidence and marked Defendants' Exhibit 122.)

MR. ASHTON: I offer in evidence separate film gate of Defendants' Machine PS16, and ask that the same be marked as Defendants' Exhibit 123 (physical).

(Received in evidence and marked Defendants' Exhibit 123.)

MR. ASHTON: I offer in evidence separate flywheel of Defendants' Machine PS16 and ask that the same be marked as Defendants' Exhibit 124 (physical).

(Received in evidence and marked Defendants' Exhibit 124.)

MR. ASHTON: I offer in evidence separate guide roller of Defendants' Machines PS1 and PS16, and ask that the same be marked as Defendants' Exhibit 125 (physical).

(Received in evidence and marked Defendants' Exhibit 125.)

MR. ASHTON: I offer in evidence File History and Contents of Engl, Massolle and Vogt United States Patent No. 1,590,185, referred to

in the specification of the patent in suit, and ask that the same be marked as Defendants' Exhibit 126.

MR. WARD: I object to it as irrelevant and immaterial, so far as the File Wrapper and Contents are concerned.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibit 126.)

MR. ASHTON: I offer in evidence page 25 of the Tuesday, December 1st, 1931, issue of the publication "Variety," containing "Notice to the Sound Film Industry,' of the plaintiff, American Tri-Ergon Corporation, and ask that the same be marked as Defendants' Exhibit 127.

(Received in evidence and marked Defendants' Exhibit 127.)

MR. ASHTON: I offer in evidence publication "The Talking Film According to the Tri-Ergon Process," Hans Vogt—Zeitschrift des Vereines Deutscher Ingenieure, Vol. 70, No. 6, dated February 6, 1926, pages 199 to 204, inclusive, with translation, and ask that the same be marked as Defendants' Exhibit 128.

(Received in evidence and marked Defendants' Exhibit 128.)

MR. ASHTON: I offer in evidence publication "The Sound Production Means of the Picture—Tonfilm, Hans Vogt—Filmtechnik, Vol. 5, April 27, 1929, pp. 202-205," with translation, and ask that the same be marked as Defendants' Exhibit 129.

(Received in evidence and marked Defendants' Exhibit 129.)

MR. ASHTON: I offer in evidence publication in the Film-Kurier of February 6th, 1932, article by Hans Vogt, with translation, and ask that the same be marked as Defendants' Exhibit 130.

(Received in evidence and marked Defendants' Exhibit 130.)

MR. ASHTON: I offer in evidence the publication entitled "Acoustin Film," Electrotechnische Zeitschrift, Volume 43, December 29th, 1922, pages 1540 and 1541, with translation, and ask that the same be marked as Defendants' Exhibit 131.

(Received in evidence and marked Defendants' Exhibit 131.)

MR. ASHTON: I offer in evidence publication "The Sounding Film, Arthur Furst, Berliner Tageblatt, No. 421, September 19, 1922," with translation, and ask that the same be marked as Defendants' Exhibit 132.

MR. WARD: It was agreed that objection to all of the above publications might be reserved and, accordingly, I object to the publications as not being competent to establish anything other than the fact that these publications and the statements therein made were printed as statements of the newspapers or publications, as the case may be, at the dates apearing thereon. I believe the Court has already ruled in this case that such publications shall have no other force or effect.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibit 132.)

MR. ASHTON: I offer in evidence a sketch by the witness Waterman, illustrating the Ernemann projector, Defendants' Exhibit 28, and ask that the same be marked as Defendants' Exhibit 133.

MR. WARD: I object to the sketch as a diagrammatic and fragmentary view, not illustrating properly the full mechanism and portion of the machine which it purports to represent.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibit 133.)

MR. ASHTON: I offer in evidence the sketch by the witness Waterman illustrating the intermittent movement of the Ernemann projector, Defendants' Exhibit 28, and ask that the same be marked as Defendants' Exhibit 134.

MR. WARD: I object to the sketch as a diagrammatic and fragmentary view, not illustrating properly the full mechanism and portion of the machine which it purports to represent.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibit 134.)

MR. ASHTON: I offer in evidence the following patents of Vogt, Massolle and Engl as Defendants' Exhibits 135, the list being as follows:

German Patents	*Item*
350,506	1
350,507	2
350,508	3
350,705	4
350,706	5

German Patents	*Item*
350,708	6
350,709	7
350,999	8
358,115	9
362,370	10
365,900	11
376,320	12
381,973	13
389,234	14
390,180	15
423,942	16
500,871	17
United States Patent	
1,555,281	18
German Patents	
157,434	19
175,284	20
Canadian Patent	
259,221	21
French Patent	
590,541	22
Austrian Patent	
102,809	23
United States Patent	
1,608,261	24
1,628,377	25

MR. WARD: I object to that as irrelevant and immaterial.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibit 135.)

(See correction, page 841.)

MR. ASHTON: I offer in evidence and ask that it be marked as Defendants' Exhibit 136, Binder of Patents cited during the prosecution in the German Patent Office of German Patents Nos. 387,058, 389,317, 389,318 and 389,319; and in the Nullity Proceedings with respect to the same four German patents, and the patents cited in the Nullity decisions with respect to German Patent No. 417,967, with translations. These patents to constitute a physical exhibit, not to be reproduced in the appeal record if an appeal is taken herein, these binders containing the following patents:

ART CITED IN GERMAN PATENT NO. 389,317.

FILE WRAPPER

G. B. 125,887

NULLITY PROCEEDINGS

Complaint	*Decision March 13, 1930*
Fr. 492,564	Fr. 472,467
	" 492,564
Ger. 185,532	
	Ger. 185,532
G. B. 17,858/99	
" 15,333/12	G. B. 15,333/12
" 115,942	" 115,942
" 125,887	" 125,887
" 166,321	" 166,321
U.S. 1,221,407	
" 1,255,143	U. S. 1,255,143
" 1,312,103	" 1,312,103

Paper of April 4, 1929

Fr. 472,467
" 492,564

Ger. 185,532
" 387,058

G. B. 15,333,12
" 115,942
" 125,887
" 166,321

U. S. 1,221,407
" 1,312,103

Paper of March 12, 1930

G. B. 15,333/12

U. S. 1,255,143
Danish Appl. 97/3 published
January 20, 1930.

ART CITED IN GERMAN PATENT NO. 389,318.

FILE WRAPPER

Fr. 415,005
" 459,537

Ger. 148,628
" 165,441
" 208,000
" 212,141
" 232,583
" 263,605

G. B. 18,057 06

Paper of April 13, 1929

Fr. 459,537
" 470,699
" 472,467
" 547,829

Ger. 130,509
" 165,441
" 263,605
" 358,840
" 358,848
" 387,058

G. B. 16,941 13
" 115,942

U. S. 1,366,446

NULLITY PROCEEDINGS

Complaint

Fr. 470,669

G. B. 115,942
" 157,985

Paper of June 1930

Fr. 470,699
" 472,467

Ger. 387,058
" 389,319

G. B. 115,942
" 157,985

U. S. 341,214
" 502,382
" 1,065,576
" 1,162,438

Drahtlose Telephonie—Ruhmer
1907—pp 27-30 Fig. 33

ART CITED IN GERMAN PATENT NO. 389,319.

FILE WRAPPER

Fr. 457,412
" 459,537

G. B. 16,991/11

NULLITY PROCEEDINGS

Complaint

Fr. 470,699

G. B. 115,942
" 157,985

Paper of April 15, 1929

Fr. 459,537
" 472,467

Ger. 387,058

G. B. 115,942

Paper of June 1930

Fr. 459,537
" 472,467

Ger. 389,318

G. B. 115,942

U. S. 341,214
" 587,527
" 1,162,433
" 1,185,056

ART CITED IN GERMAN PATENT NO. 387,058

FILE WRAPPER

Fr. 459,537

Ger. 130,509
207,777
208,000
212,141
226,248
232,583
263,605
272,351

G. B. 16,941/13
18,057/06

U. S. 865,574

NULLITY PROCEEDINGS (GRIEFF CASE)

Complaint

G. B. 2,239/12
23,620/11

Appeal

Aust. 63,313

Fr. 361,089
429,100
459,537
472,467

Ger. 130,509
185,532
207,777
208,000
212,141
226,248

Appeal (Cont'd)

Ger. 232,583
263,605
272,351
306,556
345,615

G. B. 16,941/13
17,858/99
18,057/06
23,620/11
24,563/10
100,748
115,942

U. S. 200,521
227,679
865,574
995,390
1,221,407
1,255,134
1,065,576

Paper of Mar. 12, 1930

Ger. 345,615

Statement Mar. 20, 1930

Phys. Zeit-
Ruhmer 1901

Decision

Ger. 272,351
345,615

G. B. 2239/12
23620/11

Ries "Das Selen" p. 304 (1918)

Mihaly "Der Sprechende Film"

Expert Opinion

Fr. 472,467

Ger. 272,351
345,615

Expert opinion (Cont'd)

G. B. 2239/12
23620/11
24563/10
115,942

U. S. 200,521
227,679
1,162,433

Ries "Das Selen" p. 304

ART CITED IN GERMAN PATENT NO. 387,058.

NULLITY PROCEEDING (ERPI CASE)

Complaints

G. B. 18057/06
24563/10

U. S. 1,065,576
1,255,143

Paper of Feb. 6, 1929

Fr. 361,089
429,100
472,467

Ger. 207,777
208,000
212,141
226,248
232,583

Paper of Feb. 6, 1929 (Cont'd)

G. B. 24,563/10
17,858/99
115,942

U. S. 995,390

Undated Paper

Aust. 63,313

Fr. 361,089
472,467

Germ. 185,532
272,351
306,556

U. S. 200,521
227,679
1,221,407
1,258,226

Paper of Aug. 29, 1929

Aust. 63,313

Fr. 361,089
472,467

Ger. 185,532
272,351
306,556

G. B. 18,057/06
24,563/10

U. S. 200,521
227,679
1,065,576
1,221,407
1,255,143
1,258,226

Paper of March 12 1930

Ger. 345,615

Ruhmer "Drahtlose Telephonie"
Journal Society Arts
5/10/78 p. 536
Scientific American
6/18/81 p. 394

Paper of June, 1930

Fr. 472,467
361,089

G. B. 16,941/13
24,563/10
115,942

U. S. 200,521
227,679
341,214
502,382
587,527
963,125
1,302,367
1,162,433
1,317,450

NULLITY REFERENCES AGAINST GERMAN PATENT NO. 417,967.

PHILLIPS GLOEILAMPEN
Decision September 10, 1930
Fr. 456,880
G. B. 105,589
AIEE—Transactions 1903, pp. 93-95
Zeitschrift fur Instrumentenkunde—(1905) pp. 33, 278-280—Translation

DR. S. LOEWE RADIO
Decision September 10, 1930
Fr. 448,757
456,880
459,537
Ger. 296,016
G. B. 10526/1912
16941/1913
18057/1906
105,589
107,025
"Das Selen"—Ries, pp. 301-306
Translation
"Das Licht in einen elektrischen und magnetischen Wirkungen"—(1909), p. 141, Ries Translation

(Received in evidence and marked Defendants' Exhibit 136.)

MR. ASHTON: I offer in evidence the title page and pages 43 and 45 of the brief of the party Vogt et al., in the U. S. Court of Customs and Patent Appeals in Interference No. 53,103, entitled "DeForest v. Vogt et al.," and ask that the same be marked as Defendants' Exhibit 137.

MR. WARD: I object to that as wholly irrelevant and immaterial under the authority of Gen-

eral Electric v. Mallory, 298 Fed. 579 (C. C. A. 3d), this proceeding referred to being one on an entirely different patent, having nothing to do with the subject matter of the patent in suit.

THE COURT: Overruled for the present, to be reconsidered later.

(Received in evidence and marked Defendants' Exhibit 137.)

MR. ASHTON: I offer in evidence transcript of the trial minutes and briefs for the plaintiffs in American Tri-Ergon Corporation et al., v. Robertson Equity No. 47,904, in the Supreme Court of the District of Columbia, and ask that the same be marked as Defendants' Exhibit 138; for the purpose of showing upon what the decision was based, and the same to constitute a physical exhibit if an appeal is taken in this case.

MR. WARD: No objection to the transcript of the record. Under the authorities the briefs are wholly irrelevant and immaterial, and they are objected to upon that ground.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibit 138.)

MR. ASHTON: I offer in evidence an article entitled "Sodium Amalgam for Photoelectric Equipments," by Elster and Geitel in "Annalen der Physik," new series, Vol. XLI, No. 10, 1890, with translation, and ask that the same be marked as Defendants' Exhibit 139.

(Received and marked Defendants' Exhibit 139.)

MR. ASHTON: I offer in evidence British Patent No. 3701 of 1908 to Polyphos, and ask that the same be marked as Defendants' Exhibit 140.

(Received and marked Defendants' Exhibit 140.)

MR. ASHTON: I offer in evidence application as originally filed of DeForest Patent No. 1,466,-701, granted September 4th, 1923, and copy of patent as issued, and ask that the same be marked respectively as Defendants' Exhibits 141-A and 141-B.

MR. WARD: I object to the applications so far as constituting any evidence of the state of the art, the patent itself only being pertinent for this purpose, and that being too late.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibits 141-A and 141-B.)

MR. ASHTON: I offer in evidence copy of letter of Albert G. Davis to Ira J. Adams, dated August 20th, 1925, and ask that the same be marked as Defendants' Exhibit 142.

MR. WARD: No objection.

(Received and marked Defendants' Exhibit 142.)

MR. ASHTON: I offer in evidence application as originally filed of Nicholson Patent No. 1,470,-696, of October 16th, 1923, and copy of patent as issued, and ask that the same be marked respectively as Defendants' Exhibits 143-A and 143-B.

MR. WARD: I object to this patent as not having been set up in the answer or referred to by

any of the defendants' witnesses during the trial. After setting up some ninety odd patents, and after we pressed the defendant for a list of anticipations, they gave us a revised list of patents which they would refer to at the trial, consisting of over forty, as I remember it; and now, after the trial is practically concluded, and after we are in our answering rebuttal proofs, they set up this additional patent, which we have not considered.

I further object to the exhibit on the ground that the patent issued after the effective date of the patent in suit, and upon the further ground that the application of the Nicholson patent constitutes no evidence of the state of the prior art.

Mr. Ashton: The plaintiffs have taken the position in this case that the patentees of the patent in suit were the first to suggest the use of the photoelectric cell as a practical instrument. It is for this reason that these additional patents relating to photoelectric cells have been added during the trial.

Mr. Ward: I deny the statement that the patentees have taken the position that they were the first to use a photoelectric cell for any practical purpose, if its use for measuring candlepower in a laboratory is regarded as a practical use. They have taken the position that they were the first to discover that it had the necessary desirable properties for sound reproduction, were the first to use it as such, and the ones to get up suitable circuits for such use.

The Court: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibits 143-A and 143-B.)

MR. ASHTON: I offer in evidence File History of the Bell & Tainter Patent No. 341,213, of May 4, 1886, and ask that the same be marked as Defendants' Exhibit 144.

MR. WARD: I object to this exhibit on the same ground that objection was made to the other file wrappers of the patents, so far as concerns an attempt to use them as any evidence of the state of the prior art.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibit 144.)

MR. ASHTON: I offer in evidence File History of the Bell & Tainter Patent No. 341,214, of May 4, 1886, and ask that the same be marked Defendants' Exhibit 145.

MR. WARD: I object also to this exhibit upon the same ground that objection was made to the other file wrappers of patents, so far as concerns attempt to use them as any evidence of the state of the prior art.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibit 145.)

MR. ASHTON: I offer in evidence File History of the Underhill Patent No. 995,390, granted June 13th, 1911, and ask that the same be marked as Defendants' Exhibit 147.

MR. WARD: Same objection as to the Bell & Tainter file wrappers.

THE COURT: Overruled for the present, to be reconsidered later.

(Received and marked Defendants' Exhibit 147.)

MR. ASHTON: I ask that the sketch of the British Pedersen Patent No. 115,942, referred to by the witness Waterman, and marked Exhibit 72, be remarked as Defendants' Exhibit 148.

(Received and marked Defendants' Exhibit 148.)

MR. ASHTON: I ask that this photograph be substituted for photograph Exhibit 79-C, referred to at page 798 of the record, as requested by the plaintiff, so that it might show the presser shoe used in exhibiting the model of Figure 5 of the patent in suit.

MR. WARD: No objection, other than the objection made to the other photographs, which this is substituted for.

MR. ASHTON: I ask that this photograph, referred to at page 798 of the record, which shows the test machine without any models in it, be marked Exhibit 80-A.

MR. WARD: For the clarity of the record, you mean the machine in which you tested the alleged model on the Figures 5 and 6 of the patent in suit and the alleged model of the first German patent.

MR. ASHTON: Yes, that is correct.

MR. WARD: No objection other than the one already on the record with respect to it.

MR. ASHTON: I offer in evidence as Defendants' Exhibit 149 the data which has been referred to during the testimony of Mr. Waterman with respect to the weight, moment of inertia, revolutions per minute and kinetic energy of the PS-1 and

PS-16 machines, Simplex projector, Powers projector and Ernemann II projector.

MR. WARD: I object to it as irrelevant and immaterial, and on the further ground that it is insufficient in the data it gives.

THE COURT: Overruled for the present.

(Received and marked Defendants' Exhibit 149, being tabulation with respect to weight, moment of inertia, etc., of PS-1, PS-16, etc., machines.)

IT IS STIPULATED AND AGREED that the proceedings of the Physical Society of London, Volume 32, Part II, containing the Rankine publication, which is Item 48 of the Defendants' Prior Art Book No. 1, was published and received by the Library of Congress on March 17th, 1920.

MR. ASHTON: I ask that the record be corrected at page 826 to substitute for the last paragraph the following:

"I offer in evidence the following patents of Vogt, Massolle and Engl, as Defendants' Exhibit 135."

MR. WARD: Counsel for the defendants states to me that this is a miscellaneous list of different patents of the three inventors, selected for some purposes which they have in mind, and I object to the book as irrelevant and immaterial.

THE COURT: I will overrule your objection for the present.

(Received in evidence and marked Plaintiffs' Exhibit 135.)

MR. ASHTON: I offer in evidence a list of United States, Canadian and German Patents of Vogt, Massolle and Engl, giving the numbers of

the patents, the dates of application, the title, and the names of the patentees, and I ask that the same be marked Defendants' Exhibit 150.

MR. WARD: I object to this list as irrelevant and immaterial.

THE COURT: Overruled and received for the time being.

(Received in evidence and marked Defendants' Exhibit 150.)

MR. ASHTON: The plaintiffs objected on Friday to the offer of the certificates from the Smithsonian Institute of the photographs of some of the prior machines, Bell & Tainter, Berliner and Clark, and it was suggested that this objection might be withdrawn if affidavits were obtained from the Smithsonian Institute.

Those affidavits have been obtained over the week-end, and I now offer them in evidence as follows:

Affidavit of Carl W. Mitman, dated June 26th, 1933, with photographs of the Berliner Gramophone with Clark's improvement, Catalogue No. 253,737, and I ask that the same be marked as Defendants' Exhibit 151.

MR. WARD: No objection.

(Received and marked Defendants' Exhibit 151.)

MR. ASHTON: I offer in evidence affidavit of Carl W. Mitman, dated June 26th, 1933, with respect to the Berliner Gramophone, No. 307,204, and the Bell & Tainter Machine No. 287,660 and 287,653, and ask that the same be marked as Plaintiffs' Exhibit No. 152.

MR. WARD: I object to the affidavit so far as it concerns the Bell & Tainter machine, for the

reasons stated on the record last Thursday afternoon, and on the ground that the affidavit is not proper proof; and in connection with that objection I point out that I told Mr. Ashton that Mr. Haselton had gone down there and seen this gentleman and gotten the measurements from him, which were on a card given to Mr. Haselton, and that if Mr. Ashton produced an affidavit from that gentleman setting forth those measurements as he gave them to Mr. Haselton, we would withdraw that objection. The measurements in that affidavit are not in accordance with those given to Mr. Haselton, and therefore our proposal that I would waive the technical objection to the proof has not been fulfilled, and I therefore insist upon my objection upon the ground that the matter has not been proven and that the affidavit is insufficient proof.

THE COURT: I will receive the evidence for further consideration. Objection overruled.

(Received and marked Defendants' Exhibit 152.)

MR. ASHTON: I, of course, did not bring Dr. Mitman here, just because I understood that if the accurate dimensions of that film were given, that that would be satisfactory. I don't remember copying down those measurements. Perhaps I did.

MR. WARD: They are in the stipulation.

MR. ASHTON: They are in the stipulation in the record. Are there substantial variations from the measurements which were made yesterday?

MR. HASELTON: About 30 per cent. in one case.

MR. ASHTON: May I ask whether your measurements were made with a micrometer?

MR. HASELTON: Made by Dr. Mitman with a micrometer.

MR. ASHTON: They were made yesterday with a micrometer. I can put a witness on who can state how they were made, if that will help any.

MR. WARD: I don't think so.

MR. ASHTON: I depended on your agreement.

MR. WARD: I literally followed my agreement. The measurements were given on the statement in the record.

MR. ASHTON: We will go on.

Note that Mr. Ward's remarks and mine are both referred to and followed the offer in evidence of the affidavit, Exhibit 152. This affidavit did not contain the description of the Bell & Tainter record which is in the affidavit, which I am now about to offer.

I offer in evidence affidavit of Carl W. Mitman, dated June 26, 1933, containing a description of the record strip of the Bell & Tainter Machine No. 287,660.

(Marked Defendants' Exhibit 153.)

MR. WARD: Same objection as to the last exhibit.

MR. ASHTON: I understand, Mr. Ward, that you do not object on the ground of proof in so far as it relates to the machines and the records being in the condition in which they were received, as stated in Dr. Mitman's affidavits? That they are covered in our discussion on Friday as to that point?

MR. WARD: I object to the attempted proof of the character of the record with these measurements.

MR. ASHTON: Disregarding the record, do you object as to the technical proof as to the condition of the machines otherwise? The other machines than the Bell & Tainter machine?

MR. WARD: As shown in the photographs?

MR. ASHTON: Yes.

MR. WARD: No.

IT IS STIPULATED AND AGREED by and between counsel for the parties hereto that the witness Kindelmann, if recalled, would testify that the Simplex projector substantially like Defendants' Exhibit 5 were used for projecting motion pictures prior to March 24th, 1921, with electric motor power drive.

IT IS FURTHER STIPULATED that the witness Wrede, if recalled, would testify that Powers' projector, substantially like Defendants' Exhibit 8, were used for projecting motion pictures prior to March 24th, 1921, with electric motor power drive.

IT IS FURTHER STIPULATED that Frank L. Capps, of Milford, Connecticut, if called as a witness on behalf of the defendants, would testify as follows:

That he is a manufacturer of jewels for talking machine work, and does other mechanical work in connection with the talking machine industry; that he was first connected with the phonograph business in January, 1894; that he entered the employ of the Columbia Phonograph Company of Bridgeport, Connecticut, in May, 1901, and continued in the employ of that company until Octo-

ber, 1915; that the two records, Defendants' Exhibits 154-A and 154-B, are records made in the factory of the Columbia Phonograph Company in the year 1906 and have been in his possession since that time; that records like Exhibits 154-A and 154-B were first sold by the Columbia Company in the early summer of 1906; that the records Exhibits 154-A and 154-B are not more than one-quarter of the weight of the regular phonograph records of the same width; that the said records are made of a paper base; that the material used for facing the records is celluloid with a small percentage of shellac and a small percentage of an abrasive material; and that records like Exhibits 154-A and 154-B were extensively sold during the years 1906 and 1907.

MR. ASHTON: I offer the records in evidence as Defendants' Exhibits 154-A and 154-B.

(Received in evidence and marked Defendants' Exhibits 154-A and 154-B.)

IT IS FURTHER STIPULATED AND AGREED THAT M. C. Batsel of the R. C. A. Victor Company, if called in behalf of the defendants, would testify as follows:

That the R. C. A. Photophone, Inc., was organized in September, 1927, as American Photophone Company, Inc.; that the name was changed to R. C. A. Photophone Company in February, 1928; that R. C. A. Photophone, Inc., made its first permanent commercial installation in a theatre, of sound on film talking pictures on October 28th, 1928, at the Harris' Majestic Theatre, at Johnstown, Pennsylvania; that the machines installed in that theatre at that time were sound on film machines in which a flywheel with spring, optical slit

and photo cell, were used; that the alleged infringing apparatus involved in this case, Type PS1, was installed by R. C. A. Photophone, Inc., at the State Theatre in Harrisburg, Pa., on April 11th, 1929; that the alleged infringing apparatus involved in this case, Type PS16, was installed by R. C. A. Photophone, Inc., at the Grand Theatre at Huntingdon, Pa., on September 12th, 1931; that 3647 installations of sound on film talking picture apparatus was made by R. C. A. Photophone, Inc., in the United States and Canada prior to April 30th, 1933; and 1575 such installations were made by R. C. A. Photophone, Inc., in fifty other foreign countries prior to the said date; that the following is a list of the foreign countries above referred to, and I ask that the list be copied into the record.

(The list referred to is as follows):

United Kingdom, Great Britain and Ireland
Belgium
France and Colonies
Greece
Italy
Russia
Spain
Portugal
Switzerland
Turkey
Iraq
Palestine
Egypt
Argentina
Brazil
Bermuda
Chile
Peru
Bolivia
Ecuador
Colombia
Costa Rica
Cuba
Guatemala
Honduras
British Honduras
Mexico
Nicaragua
Panama
Canal Zone
Porto Rico
Salvador
Venezuela
India
China
Japan

Philippine Islands	Australia
Siam	New Zealand
Straits Settlements	South Africa
Federated Malay States	Island of Mauritius
Java	Canada

IT IS STIPULATED that the date of the first installation of the Type PS1 machine was on October 28, 1928, in the Harris Majestic Theatre at Johnstown, Pa., and the first installation of the Type PS16 machine was made on December 22, 1929, in the Winston-Salem Theatre at Winston-Salem, N. C.

Subject to correction, it is stipulated that the first PS1 equipments installed by the R. C. A. Photophone were made by the Westinghouse Electric & Manufacturing Company of Pittsburgh, Pennsylvania.

Subject to correction, it is further stipulated and agreed that the first PS16 machines were made by the same company.

IT IS STIPULATED AND AGREED that Mr. H. M. Wilcox, if called as a witness in behalf of the defendants, would testify that the Western Electric talking picture system using the disc method was introduced to the public on August 6th, 1926, at the Warner Brothers Theatre in New York City; and that he would further testify that the following motion picture producers are now licensed to use and are using the Western Electric sound recording system in recording sound on film talking pictures, and I ask that this list be copied into the record.

(The list referred to is as follows):

UNITED STATES.

Audio-Cinema, Inc.
Cinelog Corp.
Columbia Pictures Corp.
Eastern Service Studios, Inc.
Educational Talking Pictures Co., Inc.
Firnatone Corporation
Fox-Film Corp.
Hal Roach Studios, Inc.
Metro-Goldwyn Pictures Corporation
Movietonews, Inc.
Paramount Publix Corp.
The Vitaphone Corp.
United Artists Corporation
Universal Pictures Corporation
Western Service Studios, Inc.

FOREIGN COUNTRIES.

Associated Screen News, Ltd.
British & Dominion Film Corp., Ltd.
Establissements Braunberger-Richebe, S. A.
Les Studios Paramount

MR. WARD: I object to the evidence on the ground that any installations of disc records are wholly immaterial and irrelevant to the case at issue, and furthermore that any installations made by the Western Electric Company are not concerned with the case at issue here. The patent in suit does not relate to disc recording or reproduction in any sense, and disc recording does not involve the optical slit of the patent in suit, nor the flywheel features of the patent in suit.

MR. ASHTON: You do not object to the proof, however?

MR. WARD: I object to the evidence, whether you call the witness or whether it is stipulated that if the witness were called he would testify so and so. I object to that testimony on the ground it is wholly irrelevant and immaterial.

THE COURT: I will overrule your objection as to relevancy for the present, and consider it later.

You will stipulate that if called he would so testify?

MR. WARD: I do not object to that part of it, your Honor.

MR. ASHTON: That Mr. Wilcox would further testify that there are 5602 installations of the Western Electric talking picture reproducing system made in the United States prior to May 27th, 1933; that 3564 Western Electric talking motion picture reproducing systems were made in fifty foreign countries prior to April 30th, 1933.

MR. WARD: Does that relate to discs, or what?

MR. ASHTON: Combined film and disc systems.

MR. WARD: Same objection and for the same reason.

THE COURT: The same ruling.

MR. ASHTON: Mr. Batsel, above referred to, if called, would further testify that the following motion picture producers are now licensed to use and are using the R. C. A. Photophone, Inc., sound recording system in recording sound on film talking pictures, and I ask that the list be copied into the record.

(The list above referred to is as follows):

DOMESTIC.

RKO Radio Pictures
RKO Pathe
Pathe News
Tec-Art Studios
Larry Darmour
Tiffany Studios (California)
Educational Studios
Mack Sennett
Metropolitan Motion Picture Co.
Chicago Daily News
Burton Holmes Lectures, Inc.
Ideal Sound Studios
Van Beuren Corporation
Grantland Rice Sport Pictures Inc.
RCA Victor Studios
Caravel Films
West Coast Studios
Walt Disney
Invincible
Chesterfield

FOREIGN.

ENGLAND.

Associated Radio Pictures Studios Ltd.
Gainsborough Sound Pictures, Ltd.
British Lion Film Corporation, Ltd.
Twickenham Film Studios, Ltd.
Teddington Film Studios, Ltd.
Archibald Nettlefold Productions
Publicity Films, Ltd.
Mansfield Markham
The Gaumont Company, Ltd.
British International Sound Pictures, Ltd.
The First National Pathe, Ltd.
Warner Brothers First National Productions, Ltd.

FRANCE.

Pathe Cinema
Establissements Jacques Haik

ITALY.

S. A. Immobiliare Cinematographica Italiana
Instituto Nazionale LUCE

INDIA.

Madan Theatres, Ltd.
East India Film Company

AUSTRALIA.

Efftee Productions, Ltd.

CHINA.

United Theatres, Inc.

MR. WARD: At this point I would like to have the following stipulations on the record. It is stipulated that either party may use at the argument or on the appeal copies of any patents mentioned in any published court opinions, to be relied upon by either party for the purpose of showing the subject matter of the patents and claims of any such patents referred to in any such opinions.

It is further stipulated that the plaintiffs in this suit filed a suit in the District of Delaware on the patent in suit against R. C. A. Photophone, Inc., on or about November 19th, 1931. Said suit is still pending.

FREDERICK C. BURT, called as a witness in behalf of the defendants, being first duly sworn, testified as follows:

DIRECT EXAMINATION.

By MR. ASHTON:

I live at East Orange, New Jersey. I work for T. A. Edison, Inc. I have worked for the Edison Company about twenty-eight years. I did work in the New York recording laboratory. What I did there was machine operator and recording. I recorded amusement records and commercial Edison records.

I brought this machine to Scranton this morning. I got the machine in Vault No. 5 on the Edison premises. The machine is just as it was located. I did not even blow the dirt off. Originally that machine was used in New York as a test machine for master records, at 79 Fifth Avenue, the Edison Studios. It is one of the type that we used over there. There were only probably twenty of them, and that is one of the twenty. The motor runs. It turns the mandrel. The machine is running now (illustrating). This machine, Defendants' Exhibit 155, and the machine, Exhibit 33, are practically twins. They are all the same type.

(Edison Triumph machine identified by Burt received in evidence and marked Defendants' Exhibit 155.)

Q. 19. I call your attention particularly to the bracket which supports the flywheel. Can you or can you not state whether they were made from the same pattern or mould?

A. I should say they were, yes.

These rough castings were used on these machines so that the flywheel could be put on and used to give it room to run. The rest of the machines are regular commercial Triumph machines for reproducing in the homes. Taken right out of stock. They

were converted for the recording and reproducing purposes in the New York laboratory.

There is not any attempt to show on page 10 of the Edison catalogue, Plaintiffs' Exhibit 43, the recording machine as I have testified it was converted in the Edison laboratory. The catalogue shows the machine sold to the public. The machine sold to the public did not have the flywheel which is on the two Exhibits 33 and 155.

CROSS-EXAMINATION.

By MR. WARD:

Such machines as these were only used in the Edison laboratory as production machines. The machines were used in the Edison laboratory for recording master records and testing out the same master. They were not sent out to the public. This construction minus the flywheel and bracket was sent out to the public.

MR. WARD: Is your case closed?

MR. ASHTON: Yes.

MR. WARD: I will recall Professor Ballard. Your Honor, I would like to have the program of the plaintiffs' demonstration of last Thursday evening put in the record at page 782, for the convenience of the Court.

And for the record, your Honor, I would like to state that in connection with plaintiffs' demonstrations given last Thursday evening, that after the demonstration several of the engineers representing the defendants and Mr. Waterman were given an opportunity to examine the machines demonstrated, and they spent about an hour and a half in doing so and, at their request, we took the flywheel off of the machine illustrating Figures 5 and 6 of the patent, in order that they

might examine the machine, the mechanism driving the film, and the relation of the flywheel and spring, and so forth, in the machine; in other words, we gave them access to such parts of the machine as they asked for.

WILLIAM C. BALLARD, resumed the stand for further direct examination in rebuttal.

DIRECT EXAMINATION (Continued).

By MR. WARD:

Q. 696. Professor Ballard, in connection with Item 1 of the demonstration, the West Point speech reproduction on the first machine, will you state whether that reproduction brought out anything of interest as regards the defendants' criticism of the structure of the patent in suit as to Figures 3 and 4 thereof.

A. Yes. The reproduction of this speech showed an absence of any flopping up and down of the film of the sprocket wheel at the point of translation, such as the defendants assert would take place if a special shoe were not present to prevent it. Such flopping up and down would throw the film out of focus, creating very serious loss of high frequency components of the speech record, which would be immediately noticeable. While speech records do not give much of an indication, if any, of small speed variations, they are affected by the elimination of high frequency components, and this jumping up and down of the record would tend to eliminate to a greater or less extent all of the high frequency components from the speech.

Q. 697. In connection with Item 2 of the test, music, in connection with "Fountains of Rome," you made reference to two places where there were splices in the film, this being an old film, and a place where

a part of the film had actually been removed. Did you detect whether those splices in the film created any oscillations in that machine to give you speed or frequency changes?

A. No. I detected them by a click as the joint or splice, as we call it, passed over the translation point. Because at these splices the sound record is of course disarranged, but there was no oscillation due to this. The reproduction of this music was very good on this machine, illustrating the Figures 5 and 6 of the patent.

Q. 698. And what was the quality of the reproduction of this machine with respect to the piano record?

A. I thought it was very good and I detected no speed variation which would have produced wavers in the sustained tones. As I pointed out during the demonstration, this particular piano record was a very severe test, because it was one having specially long sustained tones and was purposely recorded as a severe type of practical test of music.

Q. 699. What have you to say in regard to Item 3 of the test, the tone tests on the first machine?

A. To my ear they were quite sustained and free from irregularities, indicating good speed regulation.

Q. 700. What have you to say with regard to the frequency test on this machine as compared with the frequency test run at the defendants' demonstration?

A. In these tests we went over a wider range of frequencies than the defendants did, because it is a well known fact that the sensitivity of different human ears varies with different individuals, and we tried to make this test as universal as possible. The tests showed that the tones were quite sustained and smooth to an extent which would give good commercial reproduction, as was proven by the rendition of the piano record.

Q. 701. With regard to the demonstration of the second machine embodying Figure 2 of the patent, what have you to say as to the Admiral Beatty speech record demonstrated on that machine?

A. It was noted from this reproduction that the enunciation was extremely clear, the different syllables and the S's and so forth being very distinctly heard. In this record you could even hear the rooster crowing away off in the distance somewhere, two or three times during the demonstration.

Q. 702. And what have you to say as to the piano record played on the second machine?

A. I thought it was very good, and to my ear was slightly better, if anything, than when played on the first machine.

Q. 703. What have you to say as to Item 3 of the second machine?

A. Item 3 was the same frequency test as was run on the first machine, and the results indicated no substantial variation in speed rendition, being better, if anything, than on the first machine.

Q. 704. Reference was made on the record by me during this demonstration that there was some disturbance or interruption during one of the low notes and, at the same time, when a signal was given to the operating room. Will you please explain in more detail than you did during the demonstration what this was caused by.

A. Yes. It was simply a signal to change the intensity of the sound in the loud speaker, to adapt it to the acoustics of the room, and this gave a temporary change in the tone. The same thing occurred repeatedly during the defendants' demonstration, when they signalled to have the same thing done, according to what was being reproduced on the machine.

Q. 705. You testified that it was difficult to detect irregularities in the speed of a reproducing machine

by the use of speech records or fast music records, where the sustained tones were absent. For the convenience of the Court will you summarize here the character of the records selected by the defendants in their demonstration with respect to the various alleged models of prior art patents or prior art machines.

A. It is significant to my mind that in none of the alleged prior art models, where they demonstrated a film containing a sound record passing through the machine, did they try a single piano or tone or frequency record, or any record which in my opinion was capable of indicating small speed fluctuations, which would be detrimental to commercial reproduction.

For example, on the alleged Constable model, Item 38 of their demonstration, they used only the fast waltz record, which I have repeatedly pointed out did not give indications of variations in speed which might affect commercial sound reproduction.

In the Edison Skeleton they demonstrated nothing but speech, as I remember.

In Bell & Tainter—they did not demonstrate at all.

With the alleged Dragoumis model they demonstrated it with speech and a march record. The march record was a rapid, spirited nature, and neither of these records could give much of an indication of slight speed variations which would affect commercial reproduction. Speed variations may have been present which would not have been indicated.

With the Reel Film machine which, as far as I know, represents nothing in the prior art, they used only speech and the same fast waltz, which would give little indication of what the test was supposed to illustrate.

The Hoxie machine was used only with a speech record, and the operation of the machine was so poor that even obvious defects were noted in the speech records.

Q. 706. Was any hand driven machine or model demonstrated?

A. No. It is significant that there was not a single demonstration where a single machine was driven by hand and, notwithstanding that some of the prior art patents which these models were intended to illustrate, were hand driven devices with flywheels put on them as a component part of the hand crank mechanism.

Q. 707. With regard to the Edison Triumph, with lightweight small cylinder records, what test was that subjected to?

A. The program here says "Speech, etc.," but all I recall hearing was speech and the fast music, neither of which were of a character to indicate small variations in speed which might affect commercial sound reproduction.

MR. ASHTON: Which one is that?

MR. WARD: That was Item 18-A.

Q. 709. Now, with regard to the General Phonogram Item 47, and the Victrola, Item 48, what was the character of music played on those two machines?

A. As I remember, the composition was the Liszt Hungarian Rhapsody. The character of this composition is such that it would not give any accurate indication of the small speed fluctuations, and as already pointed out, the inherent irregular friction that would be present in reproducing from discs at the time that these machines were on the market was absent here, due to the fact that they had, as Mr. Waterman admitted, an electrically recorded record, with the latest type of oil damp pickup, thus removing all of the irregular friction load inherent in these phonogram machines, when played as they were originally designed for and at the time that they were put out.

I may also point out that it is significant that the constant pitch of the tone records, these records are

available in the open market, which defendants could have used on these two machines had they been disposed to do so, to test the alleged uniformity of speed. But in my opinion the construction and performance on these disc record machines is irrelevant anyway, since the Victrola machine is governed by a speed governor, and has the large steel plate as the record carrier, which the patent acknowledges is prior art, and in the General Phonogram model a speed governor was also used, geared to the shaft carrying the disc.

MR. ASHTON: Note on the record that Professor Ballard has been reading his statement.

Q. 710. You have pointed out in your testimony, with respect to the Edison Triumph Model as used in the demonstration, the absence of screw feeds with split nuts for producing relative longitudinal motion between the stylus and the cylinder records, the absence of any heavy stylus, tracking in the usual hard composition record that was used on those machines in their day and which created variable friction, and the use on those machines for the demonstration on soft wax records with modern electrical recording, and the use of modern electrical pickup apparatus for reproducing from those records which produce a minimum of friction. But I do not think that you have made it clear what would be the effect of these original parts on the sound recording and reproducing if the models had been used with these parts present. Will you point that out?

A. The two feed screws with the clamping nuts are a source of varying load on the shaft upon which the flywheel and the cylinder record are mounted, and is pointed out in one of the earlier Edison patents. And the substantial friction of the relatively heavy pressing stylus onto the hard composition record, as used in those old machines, was another source of

varying friction load placed on the shaft carrying the cylinder and flywheel. All of these parts are inherent component parts in the Edison Triumph machine as it stood in the prior art, and they are all sources of irregular load of the flywheel shaft.

As defendants used the machine for the demonstration, they eliminated all of these features, so that the results of the demonstration give no indication whatsoever of the character of recording or reproduction which these machines were capable of prior to the invention of the patent in suit. What defendants have done in the light of the teachings of the patent in suit is that they have simply utilized the shaft of the machine carrying a flywheel to show that this much of the structure, or this fragmentary portion of the machine, is capable of producing fairly uniform speed with the sources of irregularity of load removed.

In addition to this construction of the machine they have made records of high quality or timbre, as Mr. Waterman calls it, by modern methods, and even with such records they have used the most up-to-date frictionless electrical means of reproducing from those records to further eliminate any irregular load, so that the demonstration means nothing with respect to the original Triumph machine.

Q. 711. When we introduced Plaintiffs' Exhibit 43, the catalogue of Edison phonographs, illustrating the Edison Triumph machines and showing no flywheels on such machines, Mr. Neave made the point that that book showed machines put out to the public, whereas the Edison Triumph model demonstrated was, according to him, a special machine used in the laboratory only for recording records. Assuming, only for the purpose of this question, that Mr. Neave's statement is correct, what have you to say with respect to the use of the Edison Triumph model for reproducing in this demonstration?

A. It shows that they are using a machine for reproduction purposes which, according to Mr. Neave, as I understand him, is not intended to be used for that purpose but only for recording. I might further point out in this connection that where a machine is used for recording, you have to actually cut the record with a tool as the record revolves, and this tool is progressed by the feed screw of the machine, and both of these effects set up much greater fluctuating loads on the shaft than would be reproduced in reproducing such a record.

Q. 712. In regard to the Edison Kinetophone as demonstrated, you have pointed out at record page 762 and so forth, that with the exception of the playing of the Watson record and the minstrel record, it likewise used the modern electrical recorded wax cylinders and the modern electrical pickup without appreciable friction, and so forth, as in connection with the demonstration with the Edison Triumph machine, and that the feed screw etc., shown on the model were not used in the demonstration; but you tell me that you neglected to mention another important omission in this machine at the demonstration. What is it?

A. This machine, as I understand it, was designed for use with a motion picture machine, and the testimony of the defendants' witnesses is that the two machines were connected together by belts running the entire length of the hall or auditorium in which the machine was used, in order that the two machines might operate in supposed synchronism. The testimony was that the machines were used in theaters and auditoriums from about 35 to 200 feet in length. This would mean, of course, that the belt had to pass from the one end of the auditorium and back again, which would give belt lengths of from 75 to upwards of 400 feet. Now, it is perfectly plain that when a belt of such a length has to be driven, that substantial and

irregular loads would be produced by the belting, and of course this would react upon the shaft carrying the sound mandrel and the flywheel. The testimony of one of the witnesses, as I recall it, bore out that one of the objects, if not the object, of the flywheel was to store up enough energy so that when the synchronizing circuit was closed the flywheel would immediately bring the mandrel shaft up to the speed so as to insure synchronism between the sound record and the picture record. All of this was eliminated in the tests, so that the only thing that a test of this machine demonstrated was to what extent the shaft carrying the mandrel and flywheel could be rotated at uniform speed when taken entirely out of its natural environment and stripped of inherent component parts of the whole structure, as the machine was intended to operate and did operate when used at its date. In my opinion, the demonstration gave not the slightest indication of the character of constancy of the speed of the machine or the quality of reproduction which the machine was capable of, according to its intended use. It was simply a rebuilding of the machine in the light of this patent, for the particular purpose of the demonstration.

Q. 713. At Q. 631 you were questioned about the Amet Patent No. 1,162,433, but in your answer you referred to the Amet Patent No. 1,221,407, and read certain excerpts from the latter patent. I think the points you sought to bring out there are more clearly stated in the Patent No. 1,162,433, namely, that it was the object in that patent to insulate a sound recording apparatus from vibrations set up in the motion picture machine. Will you please refer to the specification of the said last patent, that is, the 1,162,433 patent, and point out wherein this is stated.

A. I tried to bring out that in this patent Amet provided a cushion means, between the frame of his motion

picture machine and the frame of his sound reproducer. In accordance with the same idea, he uses a sound absorbing universal joint in the shaft between his sound reproducer and his motion picture machine. This coupling is not for use as the equivalent of a spring drive to take care of irregularities in the speed of the motion picture machine shaft where that shaft is coupled to the sound reproducing machine. I find this very well expressed at page 3 of this patent, commencing line 97, as follows:

> "All extraneous vibrations that might reach the phonograph through the base are absorbed by the hollow rubber balls 9. This peculiar construction of vibration absorbing mounting will be claimed in a separate application for patent. The extension sleeve couplings 15 and 16 are respectively fixed to the ends of the drive shaft of the camera and the intermediate shaft 17. These sleeves are provided with the flanges 18 and 19 that are fixed to the heads 20 and 21 that are joined together by being fixed (preferably by adhesion) to the annular wooden or fiber ring 22. This drum-like structure is vented through the hole 23 to relieve any concussion due to end thrust from either of the joined shafts, or the heads may be open in spider-like construction. The heads 20 and 21 are preferably of oil-impregnated flexible leather, or sheet rubber, having sufficient tensile strength to transmit the power necessary for rotation without buckling or distortion. Having no sound-conducting properties the heads 20 and 21 isolate the respective machines and break up any sound vibrations in the respective drive shafts. The flexibility of this novel coupling also compensates for any disalignment of the joined shafts and acts as a 'universal joint.' "

Amet also makes it quite clear what the function of his flywheel is. It will be seen from the patent that the sound-reproducer shaft 27 is coupled with the shaft 17 by a magnetic clutch 29-31, and that the flywheel is on the shaft 17. Amet mentions his magnetic clutch and its functions on page 4, commencing line 4, and at line 15 he states:

> "The magnetic clutch comprises the magnets 29-29 fixed upon the core bar 30, that is fixed upon the end of the shaft 17 and the armature disc 31 that is slidably splined on the end of the extension shaft 27. It is the function of this clutch to instantly and positively set, to start the phonograph mandrel rotating at full speed when the clutch circuit is closed, as hereinafter described. The shaft 17 rotates constant with the camera shaft."

In other words, he points out that you must have synchronism between the picture and the sound record and, in order to accomplish this, when a motion picture machine has normal speed, there must be an instant throwing in of the clutch and the sound machine must immediately start up at rapid speed in order to maintain synchronism, and the object of the flywheel is to jerk that sound shaft 27 up to full speed as soon as the clutch is thrown in.

Q. 714. Does the Amet Patent No. 1,221,407 bring out anything further in connection with this idea?

A. Yes. I think it further emphasizes the point that what Amet is driving at is to prevent the transmission of sound-producing vibrations from being transmitted from his motion picture machine to the stylus of the sound reproducer. He states on page 1, line 37:

> "The motion picture machine and sound recording machine should be directly coupled to secure absolute synchronism in the simplest way, but

> the motion picture machine produces mechanical sounds which are apt to be made a part of the sound record and which would be objectionable in a reproduction of sounds to accompany the picture, and the direct coupling has heretofore proven unsatisfactory."

I think it will be seen that Amet was not concerning himself with any type of elastic or spring drive, such as the patent in suit or the defendants use, but quite a different type of coupling, in which he says he regards himself as a pioneer, and in what he regards himself as a pioneer is in the invention of a non-vibration transmitting coupling interposed between the ends of the two shafts taken in conjunction with non-vibrating transmission mounting interposed between the two frames of the machine. This is shown also at page 2, beginning line 47:

> "Vibration and noise is characteristic of the picture machine, while absolute silence in the mechanism of the sound recording machine is essential."

It is a question of noise transmission in which Amet is interested and not speed fluctuation.

Q. 715. There is a third Amet Patent No. 1,065,576. Will you state whether this patent sheds any light on the point that you are discussing with respect to the other two patents?

A. Yes, it does. This patent shows the sound and the motion picture machines mounted at opposite ends of the hall. A sound machine is mounted behind the screen, and the motion picture projector at the end of the hall from the screen. And there is no opportunity here of connecting the two machines directly together. They are coupled together by means of a long belt, shown in the patent, and since the problem of trans-

mitting the noise between the two machines does not enter in this patent, he obviously eliminates the sound-deadening drum which he has shown in the other patent. He still uses the flywheel to insure synchronism between the two machines, and so that when the synchronizing circuit is closed, the cylinder comes up to speed immediately, is jerked up to speed immediately under the action of the stored energy of the flywheel. Just as in the old Edison Kinetophone.

Q. 716. You have testified that the so-called Edison Skeleton model does not in your opinion correspond to any prior art patent set up. But Mr. Waterman in his testimony said something to the effect that his justification for using a film record on that machine in place of a mandrel was because of some showing in Figures 33 and 57 of the old British Edison Patent No. 1,644 of 1878. What have you to say on this point?

A. This Edison patent is an old British patent issued before either of us was born, full of prophetic suggestions, and without anything practical for sound reproduction in a modern sense.

This patent is numbered 1644 of 1878. There are some 67 little isolated figures giving these various suggestions, and it is difficult to understand from any of them what the intended operating structure is. For example, in one of the figures referred to by Mr. Waterman, Figure 33, a hand crank shaft is shown with a cylinder mounted on it, and an endless steel strip passing over the cylinder and over two guide rollers, and there is an indication of a stylus resting upon this steel band. The only thing that is stated about it is the following—and I read from page 8 of the patent, beginning at line 54:

> "Figure 33 shows a phonet in which the phonogram or sound record has been made upon an endless belt; this is a convenient arrangement for

toys, as the same may be made to imitate the bark of a dog or other noise made by an animal; and this belt may be made of steel or other hard material that allows the same to be used for a long period of time."

I think it is quite obvious that the speed variation in a dog's bark would probably not be very serious.

Figure 57 was referred to also by Mr. Waterman, and Figure 57 seems to have a somewhat close relation to Figure 58. Your Honor will find Figures 57 and 58 on the last sheet of drawings near the top. I think it is quite clear that there could be in no sense uniformity of movement in the apparatus shown in Figure 58, because it is driven by a hand crank; and the same thing seems to be true of Figure 57 as far as anything is disclosed. There is no telling whether in Figure 57, the strip, whatever it is, is driven from the windup reel or from the cylinder below the phonet or stylus, but in neither case, since there is a direct reaction between the drum on which the cylinder is wound and the sprocket, one is bound to react on the other to give irregularities in speed. As far as I have noted, no figure in this Edison British patent justifies the construction and operation of the so-called Edison Skeleton model, which consisted of a shaft having a flywheel on it and a sprocket which fed the film over the shaft, this film containing a modernly recorded sound record, and the shaft being driven by a constant speed electric motor.

The patent does not mention any flywheel.

Q. 717. At record, pages 748 to 750, you have criticized the defendants' so-called first German patent model, which they used to endeavor to prove the operativeness of the structure of the first German patent, and in that testimony you criticized the spring pressure used at the gate. Will you please state your

opinion of the strength of this spring pressure as contrasted with the spring pressure in other sound heads that you know of, used in practice.

A. The spring pressure used here is many, many times as great as that which I have ever seen in any other sound head, and to me seems entirely inordinate and unreasonable.

Q. 718. You have also pointed out in your testimony with respect to this model that instead of having smooth rollers the rollers used by defendants had a guiding flange for the film on one edge of the roller, and parts of slightly different diameter along the width of the roller where it engages the film; and that a very heavy steel spring was used to press the rollers together with extreme pressure. Will you please state what the effect of this construction would be, and whether it is justified by anything in the German patent?

A. In my estimation there is nothing in the German patent which would justify this peculiar structure. The effect of it seems to be to have the rollers exert a sort of an embossing effect upon the film as it passes between the rollers. As I have said before, the emulsion on the film being in contact with the lower roller would probably not resist the pressure very long. The construction was undoubtedly provided for the purpose of guiding the film to make a track between the rollers, so as not to slip off, and to get a better grip on the film. There is no suggestion of any such construction or operation in the first German patent.

Q. 719. I hand you a sheet of drawings and ask you what they are.

A. This sheet of drawings is apparently a pencil reproduction of the drawing of Figure 1 of the German Patent No. 387,058, and a schematic drawing of the defendants' interpretation of this Figure 1 of the German patent.

Q. 720. You say it is apparently a schematic drawing. Have you checked them up to see if they accurately or substantially accurately represent the two structures, or have you not?

A. I believe that the lower drawing was made by tracing from the photograph of the defendants' model, and of course would give a substantially correct relation. It is not a full sized drawing. I think the same thing is true of the upper drawing, which was apparently traced from the drawing shown in the early German patent.

MR. WARD: I will offer it for identification.

(Pencil drawing of Figure 1 of German Patent No. 387,058 marked Plaintiffs' Exhibit 46 for Identification.)

Q. 721. After you and the plaintiffs' other representatives were given an examination of this machine did you ask for some additional tests that night after the demonstration given to the Court?

A. Yes, we did, and they very courteously complied with our request and gave us these additional tests.

Q. 722. Will you please state the object of some of these tests and the results?

A. It was quite evident that the spring pressure at the gate was entirely inordinate, and we asked them to remove the spring and put on less pressure. They insisted that they must have enough pressure to prevent the traveling film from displacing the upper member of the gate, so they put on a double elastic band, or two elastic bands, which in themselves gave substantial spring pressure, but greatly less than the spring that they used, but still sufficient to hold the top portion of the gate down at the film. We ran this machine with one of their test records—I believe it was a tone record

—and the irregularities in speed were very, very pronounced, and to such an extent as to make it entirely impossible from a commercial standpoint.

We then asked them to replace the heavy spring on the gate, just as they had it in the original demonstration, and to remove the film from the special large sprocket that they had provided, and to drive the film by the small sprocket on the machine to the left of the big sprocket. When we criticised the big sprocket Mr. Waterman said it would run just as well on the small sprocket if we wanted it, if we wanted to hear it, and when we asked to have it run on the small sprocket the result was terrible. Mr. Waterman in his testimony, as I remember, in court the next morning, without referring to these specific tests that we had run, said that the small sprocket was a regular holdback sprocket, was not a carefully made sprocket for feeding film. I think this latter statement which he made is of very considerable significance when we come to consider the Pedersen prior art patent which he has already referred to.

Q. 723. What have you to say as to whether this model embodied any principles not shown or taught in the first German patent which caused the model to operate?

A. The particular construction which they selected and used in this model provided a relatively short straight span of the film under very considerable tension between the gate and the pressure rollers, and the carrying of the film over a guide roller around which it was bent, and then providing a long span between that guide roller around which the film was bent and the sprocket roller which drove the film. The span between the pressure plate at the translation point and the pinch rollers is only a small fraction of the span of film from the pressure roller over the guide roller and to the sprocket.

In my opinion, the defendants, in building this model, have adopted several of the theories worked out and enunciated by Mr. Kellogg, one of their engineers, who has been present throughout this trial, and as set forth in an article by him commencing on page 665 of the Journal of the Society of Motion Picture Engineers, which has already been put in as a plaintiffs' exhibit, I believe, in this trial.

Referring to the Figure 7 on page 665 of the article, the gate at the translation point in defendants' model may be compared to the guide roller at the left marked A, and the pressure rollers with the flywheel corresponds to the pressure roller marked B in the center of this diagram. The guide roller around which the film is bent corresponds to the guide roller marked C on this diagram. The stretch between the pinch rollers and the gate corresponds to the portion of film between the roller A and the roller B of Figure 7, and the stretch between the pressure rollers and the takeup sprocket corresponds to the length of film from B around the guide roller C to the takeup sprocket.

The author discusses that under these conditions a situation where instability may be produced is sometimes noted, and states, beginning with the last paragraph on page 665:

> "Two ways of preventing such instability are now evident—first, provide positive guiding at B, B in this case being the pressure rollers, or, secondly, make it easier for the kink to occur between B and C than between A and B."

In the terms of the defendants' model, that means that any kink should be prevented from occurring between the gate and the pressure rollers and allowed perhaps to occur on the other side of the pressure rollers, or between the pressure rollers and the takeup sprocket.

(Continuing reading): "The second plan means making the film as stiff as possible between A and B, and flexible with respect to taking up edgewise displacements between B and C. The desired stiffness is helped by making this span short and straight or supported, and having considerable tension, while the flexibility is helped by low tension, a long span, and by carrying the film around the bend."

I call attention to the fact that in the defendants' model a long span was utilized on a film, was carried around the bend, "the desirability of low film tension on the feeding off side of the pressure rollers suggests the advisability of overdriving rather than under driving the drum, and this feature has been incorporated in the commercial design."

This last statement refers to the equipment that Mr. Kellogg is describing, and of course does not refer to the equipment which the defendants demonstrated.

Q. 724. With reference to the defendants' alleged model of Figures 5 and 6 of the patent in suit, I refer you to your answer to Q. 654 on page 752, and ask you if that answer reads as you intended it to and, if not, states what the facts are that you sought to bring out there.

A. For some reason or other the answer as taken down is quite unintelligible, but what I actually intended to bring out was the following:

I think it is perfectly obvious to anyone skilled in the art, when one wants to use a pressure roller to press a film in contact with a sprocket, the design of the roller should conform to the design of the sprocket. In the defendants' apparatus, a standard guide roller was used which was designed to press upon the film in a narrow space just inside and outside the rows of perforations on both edges of the film, in cases where two rows of sprockets would be used on the roller. The defendants cut off one row of these sprocket teeth,

but still used the original roller, and hence one end of the roller pressed down upon the overhanging part of the film, which was otherwise unsupported, and caused it to buckle near the point of translation, as would obviously be expected. Instead of having the roller press on the film at a point where it is supported on the smooth part of the sprocket inside of the outer edge of the sprocket, they had the roller press on the unsupported part of the film at which it overhung the sprocket. The rollers used by the defendant in this model were of large diameter, which would press the film where it overhung the sprocket, and are quite clearly shown in the left-hand side of Defendants' Exhibits 79-B and 81-A; and I would like to point out to your Honor where on Exhibit 81 the roller protrudes past the edge of the sprocket which has been cut away, and presses upon a part of the film which is completely unsupported and overhangs the sprocket, whereas, with regard to the part of the film which is on the sprocket the only pressure is exerted on the two sides of the row of perforations on the right-hand side of the sprocket. There is no pressure at the outer edge of the sprocket which would have tended to hold the film into engagement with the sprocket. The only pressure exerted being that on the unsupported part of the film. This is also shown clearly in Exhibit 79-B at approximately the same position.

Q. 725. In discussing the patent in suit, Mr. Waterman stated in connection with the optical system of the patent in suit that "the line of light for acoustic operation is focused on the gate through which the film travels," and he further testified at Record page 1346 that in so far as an optical slit is disclosed in the patent in suit, it does not differ from that which Hoxie and his co-workers testified that Hoxie had used. Do you agree with this testimony?

A. In the patent in suit the line of light for acoustic operation is not focussed on a gate, if by "gate" Mr. Waterman meant a mechanical slit. The patent shows and describes an optical system in which the light is focussed to a line on the film—what is known as an optical slit. I have already brought this out in my prior testimony in this case. Mr. Hoxie and his co-workers, however, testified that Hoxie used a mechanical slit upon which the light beam falls, and which determines the width and length of the line of light used on the film. It is not true, therefore, that the optical system of the patent in suit is the same as that used by Mr. Hoxie. There is a vast difference from a practical standpoint between a mechanical and an optical slit. The mechanical slit, consisting of a very narrow opening very close to the film, fills up with dirt and pieces of film emulsion, very rapidly and, in many tests which I made, using mechanical slits in the early part of my experimentations, the records have been completely ruined by the slit filling with dirt. It can be noted on the Hoxie record offered in evidence that there are several long transparent streaks in the record, which were obviously caused by chunks of dirt lodging in the slit, and had the chunk of dirt been in a more unfavorable position, that is, near the edge of the record where the modulation existed, it might have prevented any reproduction from this record.

Q. 726. With respect to the patent in suit, Mr. Waterman testified in substance in connection with the spring drive of Figures 5 and 6 that in the case of a rotating weighty mass and a spring drive for the same, you may have oscillatory vibrations at any speed determined by the weight of the flywheel and the stiffness of the spring; and that every such spring rotative mass combination has a natural period of oscillation which it tends to take up; and it has been known that this period is calculable, and so forth; and that if anywhere

in the system there is something which might disturb the rotation of the mass at a frequency sufficiently near to its natural frequency so as to set it in oscillation, the combination is not operative without some damping means. What have you to say on this point?

A. I think it was well known prior to the date of the patent in suit that oscillations might be set up by some disturbing factor and a combination of rotating mass and spring drive, if they were not properly designed with respect to one another. Then, as Mr. Waterman points out, the frequency of such oscillations are calculable and measurable. This was well understood by engineers and, if you improperly designed springs with a given flywheel, you can readily get oscillations if you have a disturbing factor with proper frequency. This seems to me to be just exactly what the defendants have done in this case in their demonstration. They have used a short stiff spring instead of one properly designed for the purposes of the patent in suit. A proper design for the patent in suit would be one which the natural period of oscillation of the combination is safely below frequencies that are liable to be encountered in the driving system and, as I have already pointed out, the disturbing factor in the machine used by the defendants in their demonstration was the synchronous motor whose characteristic of setting up oscillation is notoriously well known.

Q. 727. With regard to the first German patent, Mr. Waterman says that in that "the light may go through the film while it is going over the roller," meaning one of the pinch or pressure rollers, r_1, r_2. Do you find any disclosure in that patent about the film going over either of these rollers?

A. No, I do not, if by that he means any idea of bending or wrapping the film over any substantial portion of either of the rollers. The patent shows nothing

but a tangential contact between the straight film as it is pressed between the two rollers.

Q. 728. A great deal has been said here by defendants' witnesses with regard to flywheel and various kinds of prior art patent structures, and alleged prior use machines. Will you please explain in a general way and by some simple analogy the differences in function of flywheels as used by the patent in suit and in defendants' structures, and flywheels as generally or commonly used and, if you care to, you may refer to the textbook by Rankine, Defendants' Exhibit 71, that Mr. Waterman read from.

A. Referring first to page 409 of this exhibit, Mr. Waterman quoted the statement:

> "When but one flywheel is used, it should be placed in as direct connection as possible with that part of the mechanism where the greatest amount of fluctuation originates; but when it originates at two or more points, it is best to have a flywheel in connection with each of those points."

After this quotation, as I remember, Mr. Waterman stated that the author meant by that quotation that it was common to find a cumulative building up of speed variations in a machine so that a certain point behaves as though it was subject to many erratic speed fluctuations, and that the author in this quotation says that that is the place to put the flywheel; namely, at the point where you have the cumulative building up of speed variations, so as to smooth out the cumulative fluctuations.

In my opinion, the author says nothing of the kind. He very distinctly states that the flywheel should be placed in as direct connection as possible with the part where the greatest amount of fluctuation originates. That means that if fluctuation originates at the source of driving power, such as with the prime

mover, that the author mentions, you would put the flywheel there; and following the author's advise as applied to a sound picture machine, you would put the flywheel at or as close as possible with the driving motor where the speed irregularities or fluctuations originate, to use the author's own words.

Still further following the author's advice as applied to sound picture machines, a next important, if not most important, source of fluctuation is at the intermittent movement of the motion picture projector, and you would put a flywheel there. In neither of these places does the flywheel produce the results sought in sound reproduction.

The great bulk of uses for the flywheel is of the character referred to by the author, but the use of the flywheel for the purpose of the patent in suit is distinctly different.

For example, the author states at page 409 of this article that the flywheel reduces the coefficient of fluctuation of speed into a certain fixed amount and "for machinery for fine purposes," he says the coefficient of fluctuation is reduced down to one-fiftieth or one-sixtieth. Such a reduction defined for fine purposes by the author is totally inadequate for the purposes of the patent in suit where the reduction must be to a small fraction of 1 per cent.

This illustrates that the flywheel in the two cases serves distinctly different purposes. The author further states at page 410 of this article:

> "The rim of a flywheel of a factory steam engine is very often provided with teeth or with a belt, in order that it may directly drive the machinery of the factory."

> Mr. Ashton: I do not like to object, your Honor, but this is certainly straightforward argument and nothing else. I don't know how long

Professor Ballard is going on reading the depositions that he is making, which he worked up over the week-end, which are purely argumentative. He can, if he wants, perhaps, but it seems to me to be wholly argumentative and something that his counsel can do just as well later on.

THE COURT: Of course, he is introduced here as an expert engineer and mechanic and physicist, and it is difficult for the Court to separate argument from pure opinion, if it be such mixture. I think you will have to let him go ahead.

MR. WARD: Mr. Ashton's characterization is very unfair. Mr. Waterman has drawn a conclusion from a textbook, and the conclusion is wholly unjustified, and Professor Ballard is pointing that out.

THE COURT: I will allow the testimony.

A. (Continued.) I had just quoted from the middle of page 410 of the Rankine article.

Such a construction and use is entirely suitable for such flywheel purposes where the flywheel is used to regulate the speed of the prime mover, but to put any such irregular loads of this kind on a flywheel of the patent in suit would destroy the very object of its use.

In the type of flywheel used in the patent in suit and by the defendants, the flywheel is not used to control or regulate the speed of the driving motor or the power shaft of the machine, or to eliminate irregularities in the gearing between the prime mover and the flywheel, including the gearing and the motion picture part of the machine; but it accepts these as they are, and acts only to give to the small length of the film passing over the flywheel roller or flywheel sprocket the constancy of speed of the flywheel itself at the time the film is passing over it.

The patent makes no attempt to regulate the speed of the motor by this flywheel or to eliminate any irregularities in the motion picture machine with which the motion picture and sound head gearing is connected, but the flywheel of the patent is placed between all of these sources of irregularities, and the part of the film passing the translation point. In this position it functions as a filter to filter out the irregularities from the motion of the film; hence its common designation in the art as a filter flywheel, as distinguishing it from other kinds of flywheel that is put down at the motor on the motion picture head. This filter flywheel is perfectly placed as far as possible from the driving source and the source of irregularities, and merely acts to keep the irregularities off the film or that part of the film which is passing the translation point. Where a spring drive is used, it is particularly applicable, because the spring drive allows the filter flywheel to continue its even constant rotation without being pulled back by irregularities that may occur in the motor. The spring serves to put the flywheel further away from the source of irregularities; and in this connection I think your Honor can see that it has a totally different function from flywheels used on steam engines, where the attempt is made to reduce the irregularities, to reduce the irregularities of the driving steam engine at the source of power.

If I may use a very homely illustration, suppose the occasion arises of transporting an invalid that cannot be subject to any jolting, over a distance over a road that is very rough. There are two ways of solving this problem. One is to get the road smoothed out, to take the irregularities out of the road, and then you may use a lumber wagon or some other conveyance that has no springs on it at all, and you can carry your invalid over the road without being subject to any vibrations. The other is to let the road stand as it is

and use an automobile. In an automobile the body is suspended by springs. The automobile wheels take the irregularities of the road as they find them and prevent them from reacting upon the passenger which is being carried. This is a very homely illustration, but I think it has opportunities for illustrating this difference. In the one case we eliminate the sources of the irregularities and, in the other case, we let the irregularities exist as they may, but prevent them from reaching a critical part.

Q. 729. And in the first illustration, you eliminate the source of the irregularities at what point?

A. That would correspond to the location of a large flywheel at the driving motor, or wherever the irregularities were produced. A large flywheel perhaps on each gear.

Q. 730. And in the second case that would illustrate what?

A. That would illustrate the effect of this so-called filter flywheel, which prevents the effect of these irregularities from reaching the critical point.

Q. 731. Mr. Waterman, in discussing the prior art in connection with the patent in suit, stated with respect to the patent in suit:

"If the film is passing over a roller, it is the roller that is maintained at constant speed, and the film is only maintained at constant speed if it sticks to the roller;" and that when the film is rolling over the roller, you can give it the property of a weighty mass to the extent that you keep the film with the roller, because it is the roller that has the constant speed.

What have you to say with respect to this testimony in connection with contrasting the problem solved by the flywheel of the patent in suit and the uses of flywheels or heavy rotating masses in the case of gramophones, with disc or cylinder records?

A. I of course do not agree with Mr. Waterman that the property of the weighty mass is not transferred to the film. In my estimation it is effectively transferred to that portion of the film which is passing the translation point, as long as the translation point is either at the roller or in proximity to it, just as the patent states that the weighty mass is transferred to the film, but it is a distinctly different problem and a distinctly different thing from the case where they simply place a disc or cylindrical sound record on a moving plate or table or mandrel upon which the disc or cylinder record, the sound record, moves as a unit. To my mind it is an entirely different thought, and Mr. Waterman seems to appreciate this in his testimony, where he points out that there is a difference between these two things.

Q. 732. Some of the defendants' witnesses have testified that the flywheel on the shaft of the intermittent movement in a motion picture projector is to give uniform movement of the sprocket carrying the film, and Mr. Waterman has testified, page 679, that what the patentees have done here is to preserve the flywheel on the Ernemann motion picture projector, which he showed in a sketch, and simply take out the intermittent movement. What have you to say with regard to this testimony?

A. I think that this testimony is entirely without foundation in fact. As the patent clearly points out, the function of the flywheel in the sound head is to impart to the film the property of a weighty mass, and thus to tend to maintain it at uniform speed, while if the flywheel in the picture projector had the same property of imparting to the film this property of a weighty mass, it would make it absolutely impossible for the film to advance in jumps, such as is necessary in the picture projector in which the film is moved rapidly during one part of the cycle and remains at

rest during the remainder of the cycle. The two effects are diametrically opposite. In the patent in suit the flywheel moves the film continuously at constant speed, and that is its function. In the motion picture machine the intermittent movement, the film alternately comes to a dead stop and starts again, and comes to another stop, and so forth, and the purpose of the flywheel is to store up energy to cause this intermittent movement to proceed to rotate the intermittent sprocket after each of these stops, so as to prevent it from locking. This was made clear by the demonstration given in connection with one of these projectors—I think it was the Simplex Projector—from which the flywheel was taken off, and your Honor turned the hand crank and found it turned much harder with the flywheel off than it did before, and it required much greater effort to turn it at one part of the revolution than at others. It seemed to stick periodically. That effort was necessary to carry the intermittent movement through its cycle of operation, and the effort became harder at the part of the cycle after the period of stop of the intermittent sprocket. If the intermittent movement was not there, there would be no irregularity in effort whatsoever. There would be no substantial difference in turning the crank with or without the flywheel if the intermittent movement had not been present.

I think this demonstration clearly shows that the function of the flywheel on the intermittent movement of a motion picture projector is entirely different from the function of the flywheel on a sound reproducer as used by the patent in suit and by the defendants in the sound head. The flywheel in the picture projector stores up energy during the time that the film is stationary and gives it up in a very short period of time in which it is required to move the film,

so that the succeeding picture is projected on the screen.

Q. 733. Now I refer you to the British Pedersen Patent No. 115,942, in connection with which Mr. Waterman testified at page 658, in substance, that Pedersen states in the patent that the flywheels are in the sound apparatus and should be particularly large, as compared also with the standard of the picture projector, and he produces a sketch, Exhibit 148, which he says illustrates what he understood Pedersen's construction to be. Do you agree or disagree with that testimony and with the showing of the sketch?

A. I decidedly disagree with his testimony as to what Pedersen discloses and, in my estimation, the sketch does not represent what Pedersen teaches. Pedersen does not state that any flywheel is to be put on the sound apparatus as distinguished from having one in the motion picture apparatus. Much less does he say that it must be a particularly large flywheel as compared with the standard picture projector flywheel. Pedersen proposes to make the record on one of the continuously moving sprockets of the motion picture camera.

Q. 734. Make what record?

A. The sound record. And to likewise reproduce the sound record on one of the continuously moving sprockets of the picture projector. Continuously in this case being to distinguish from intermittent. He specifically does not provide any special gear for feeding the film where the sound is to be recorded or reproduced, but states that he proposes to use some existing gear in the machine. He states on page 2, line 22:

> "It is to be mentioned that the recording of the sound waves should be done at a position

where the film receives uniform motion, for example, on the delivery drum or feed reel. Similarly, the needle of the reproducing apparatus glides on the winding drum or uniformly rotating transmitting drum."

These terms have a very definite meaning in the art and are used to represent distinct parts of motion picture apparatus. The reference to uniform motion, as I interpret it, means that the record must be made at some place where a sprocket or reel is in uniform motion, in contradistinction to intermittent motion. It cannot be uniform speed, as we are dealing with it here.

Q. 735. Why is that?

A. In dealing with it here, I had reference to uniform speed such as is necessary in modern high grade sound-reproducing equipment, and it is well known that the motion of the feed rolls and takeup sprockets in the average motion picture machine is extremely irregular. It was demonstrated, I think very clearly the other night, when the film was driven by the takeup sprocket in what the defendants claim was the early German model, and which the pulsations were so bad as to make reproduction entirely non-commercial.

Q. 736. That is, the point you make is that the term "uniform motion" in connection with the statement that the translation is upon these reels, shows that it could not be the kind of uniform motion the patent is talking about?

A. Oh, no. It merely distinguishes between uniform and intermittent motion. The film moves in intermittent motion through a considerable part of the projector, and only at the point at which it enters the projector and leaves the projector does it move at even an approximately constant speed.

Q. 737. Now, will you continue.

A. He further states at line 29 of the same page:

> "The sound is exceedingly sensitive to variation in rotating speed as will be noticed in any gramophone, and it is necessary to obviate this specially during the producing and the reproducing operations by providing particularly large flywheels for example."

As I interpret this statement, Pedersen never makes reference to the fact that in recording or reproducing sound is in general sensitive to variations in rotating speed, as shown in any gramophone, and he merely states that to obviate this, particularly large flywheels should be used; and all that is implied in the statement beginning line 29 to line 33 on page 2, is that the flywheel usually supplied with motion picture apparatus should be of a larger size than is normally used.

There is no indication whatsoever of any additional flywheel nor of any changes in the location of the usual motion picture flywheel.

Furthermore, as the film is driven by one of the continuously rotating sprockets of the motion picture apparatus, the results will be similar to those which were demonstrated by Mr. Waterman when we asked him to drive the film in the alleged German patent model, which I have already commented upon. To my mind, Pedersen teaches nothing except that the flywheel of his motion picture camera or projector should be made larger than usual on account of the fact that he is dealing with sound.

I cannot find any justification in the patent for the sketch which Mr. Waterman made showing the flywheel directly on the sprocket shaft where the sound is translated to and from the film, nor the showing of the film wrapped around the sprocket at this point. The patent in my mind shows many totally inopera-

tive features for sound reproducing and recording. The recording apparatus shown in Figure 1 is of such extremely crude construction that any record which it might be capable of producing would be so poor that the effect of speed fluctuation, if any, should it exist, would be almost unnoticed.

The reproducing apparatus of Figure 2, even assuming that the stylus record could be made by some process not described in the patent, would give a reproduction wholly unacceptable, as it shows a contact between two wire brushes, which is alternately made and broken, to reproduce the sound; and this, as anyone who has ever had experience with this type of apparatus knows, is a wholly impractical idea.

The reproduction, of course, would be so poor as not to indicate the effect of any speed fluctuations due to its extremely poor quality.

Q. 738. Mr. Waterman referred to Ries Patent No. 1,473,976, and stated that the specification described in several places the need of having the film move at a uniform speed. Will you please state what in your opinion this patent discloses with reference to any flywheel, and uniform speed of the film.

A. This patent, although rather voluminous, nowhere suggests or discloses a flywheel. It does disclose the suggestion for a combined sound and motion picture machine in which the film moves intermittently past the picture projection, and non-intermittently past the sound part of the machine.

As I interpret this patent, he uses the term "uniform rate" in describing the motion of the film in the sound part of the machine, merely to distinguish from the intermittent movement in the picture head. For example, at page 1, line 78, he states that "The film is moved preferably at a uniform rate past the window aperture or slit, in photographing the sonorous action

at a speed such as to differentiate the imprints of the denser and more attenuated parts," and so forth.

This statement seems to me to indicate that Ries did not appreciate the necessity of having the film move at even an approximate rate, and that he perhaps had some idea that the record might be made while the film was moving at an intermittent rate, such as it does through the picture projector part of the apparatus.

A further description is given on page 2, beginning with line 60:

> "Referring now to Fig. 1, the film in its downward travel through casing 2, passes in succession over the upper guide roll 7, upper positively-driven feed sprocket or drum 8, and its guide roller 9, by the action of which the film is unwound at a uniform rate of speed from the upper reel (not shown) and is caused to form the upper loop 18."

Skipping down to line 77:

> "Reel 4 is provided with the usual 'takeup' device provided with a friction pulley or its equivalent 5 and driven by belt 6 from some uniformly revolving portion of the camera, which may be operated by hand or by a small motor (not shown) provided with a differential speed control," and so forth.

This indicates very clearly that the requirements of accurate speed in moving the film past the translation were not appreciated by Ries, and quite to the contrary, he labored under the misapprehension that the device could be operated by hand crank, which has been testified as being completely commercially inoperative.

Q. 739. What is your own opinion on that point?

A. My own opinion, of course, is that it coincides with the testimony in that respect which has been given—that any device operated by hand crank has inherently such wide speed fluctuations that acceptable reproduction is impossible.

Q. 740. Do I understand from this part of the specification to which you have referred between lines 60 and 88, I believe it is, and in connection with the drawings, that the film is progressed through the sound head at the lower part of the drawing by the windup reel?

A. There is no other means shown for pulling the film down through the sound head, other than the windup reel 4 which is driven by a belt 6 around the pulley 5.

Q. 741. And will you state your opinion as to the probability or possibility of getting a uniform movement of the film past the translation point, where it is driven by a windup reel.

A. The irregularities of motion on the windup reel in normal motion picture apparatus, in which no sound equipment is provided, are so great that it is usually customary to place a small sprocket which holds the film back before it is wound up on the windup reel. That is done in order to prevent the flopping and fluctuations of the film as it passes onto the windup reel, from affecting the picture.

Since the sound record is many times more sensitive to speed fluctuations and variations as compared to the picture, which is practically totally insensitive in this respect, it is quite obvious that such an arrangement as shown in Figure 1 is commercially inoperative due to the wide fluctuations of speed indicated in Figure 1.

Q. 741a. Mr. Waterman referred to the Trowbridge Patent No. 1,447,913, and stated that it was for

an oscillograph, and that for a true record "if they are going to appear in their true light, they must appear related on through at uniform distances corresponding to uniform times. So it has been very customary to employ a flywheel." And he states that it is provided with a flywheel to give uniform speed. What have you to say in regard to this testimony and the Trowbridge patent?

A. In apparatus of this type it is not at all necessary to have uniform speed. It is merely necessary to have some means of reference on the film, so that the speed intervals, the length of time corresponding to any given record on the film, can be computed.

That is done in modern oscillographs today by having one of the elements record a sixty cycle wave, or wave of some known frequency.

In the Trowbridge patent a special arrangement was provided, which drew a line across the record at every one one-hundredth of a second.

As was pointed out by Mr. Duryea, one of the inventors of this apparatus, these lines did not appear at uniform spacing on the records, which were put in in exhibitions, and it was quite evident without any special measuring equipment to see that the film had not moved through the machine at anything like constant or uniform speed, because there was a variation in the spacing of the transverse lines.

Furthermore, this equipment is not intended to measure pressures direct when used with high-speed gas engines, but gives a record which technically is known as the first derivative of the pressure record; that is, in simple terms, the indication of the record is not directly that of pressure, but of the rate at which the pressure was changing. Obviously, if you try to reproduce such a record, you get an absolutely unintelligible result. The record produced by the equipment

is such that it cannot be reproduced into sound, even if this before-mentioned difficulty does not exist.

The apparatus is interesting in that it is intended to make short records on sensitive sensitized paper, and these records are then cut off by the motion of the lever and developed in the apparatus itself. This of course would prevent the equipment being used for making extended sound records, such as those contemplated in the patent in suit.

The patent shows a flywheel on one of the shafts which is also connected directly through a series of gears with other moving parts on the machine, and as the measurements on the record have aptly illustrated, this flywheel does not move at constant speed nor does the film move through the equipment at constant speed on account of the large number of irregularities induced by the equipment itself.

I do not see that this patent teaches anything with respect to the problem solved by the patent in suit.

MR. WARD: Your Honor, in connection with the Trowbridge patent, I offer in evidence an article entitled "A New Type of Indicator for High Speed Internal Combustion Engines," by Professor Augustus Trowbridge, in Power, commencing at page 704, Volume 53, No. 18, dated May 3d, 1921, describing this apparatus, and ask that it be marked Plaintiffs' Exhibit 47.

(Received in evidence and marked Plaintiffs' Exhibit 47.)

Q. 742. You referred to the Ries Patent No. 1,473,976 and there is another Ries patent that defendants have set up, No. 1,607,480. I will ask you if you will refer to this latter patent and state whether that patent shows or suggests the use of any flywheel for giving the film uniform motion through the sound head.

A. This patent was issued from the same applica-

tion on which the previously mentioned patent issued, and is for a method of reproducing photographic sound records. There is no flywheel illustrated or mentioned in the entire patent.

Q. 743. And was any flywheel mentioned or illustrated in the other patent No. 1,473,976?

A. No, there was not.

Q. 744. Now, will you state whether in these patents the mechanical or the optical slit is used?

A. A so-called mechanical slit is used in both of these Ries patents, that is to say, there is a small narrow restricted opening in what appears to be direct contact with the film and which would of course have all of the disadvantages as to being clogged with dirt that I previously mentioned.

Q. 745. The first of these patents that you discussed, namely, No. 1,473,976, is for the sound recording method, and the second patent, No. 1,607,480, is for the reproducer. Will you state what kind of light-sensitive device is disclosed in this patent?

A. A selenium cell is specifically mentioned.

Q. 746. Is it also indicated in the drawing of Figure 1?

A. It is.

Q. 747. Defendants built the alleged model of the Dragoumis French Patent No. 472,467, which they demonstrated; and you have already criticised this model. Will you please refer to the Dragoumis patent itself and briefly comment upon it?

A. The patent does not say a word about a flywheel or about any uniformity of speed of the film or any kind of uniform motion. The defendants apparently have simply assumed that a driving pulley, shown in the foreground of the patent and not even mentioned or given a reference numeral, was intended to be used as a flywheel to produce a uniform movement.

A belt which is shown in Figure 1 of the drawing, not mentioned, which is supposed to apply power to the machine through the pulley; the shaft 2 carrying the pulley has a gear wheel which is geared through a train of gears, more clearly shown in Figure 2 of the patent, and is geared to a shaft carrying a lead screw, which moves the stylus carriage back and forth longitudinally of the shaft by some engagement of a nut with the shaft, such as is shown in some of the early old Edison models. And this carriage screw, indicated, I believe, at 18, carries the stylus which presses upon the film record. The other end of this carriage shaft is in turn geared to another train of gears connected with an indicator and a hand crank handle 19. All of this mechanism will result in heavy irregular loads being thrown upon the shaft 2 carrying the pulley and, in my opinion, it would be impossible to obtain uniformity of speed of the drum 1 over which the strip of material 8 passes.

For some reason the defendants found it advisable in their model to omit all of this mechanism involving these inherent irregularities of load on the flywheel. I do not see that the patent teaches anything with reference to the patent in suit.

Q. 748. Will you please refer to Bell & Tainter patents Nos. 341,213 and 341,214, mentioned by Mr. Waterman. Defendants produced an alleged model illustrating one of the patents, but did not demonstrate it, so I wish you would discuss these patents as to their different features.

A. First let me refer to Patent No. 341,213. This patent shows in Figure 1 a machine for making sound records for scientific investigation, because there is no means shown or means indicated whereby it could be reproduced.

With regard to this particular mechanism, there are three important features to be considered:

First, it is a hand-cranked machine, in which the hand wheel forms a component part of the hand cranking device or drive mechanism, and it is well known that no hand-cranked machine can give real uniform speed, such as is suitable for proper sound reproduction. This was admitted by one of the defendants' practical witnesses, as I remember it.

Secondly, the shaft 7, which is hand cranked as shown in this patent, is geared by a set of bevel gears, which, through a thread on the shaft 5, moves this shaft carrying the disc F-E, and all of this gearing longitudinally back and forth with respect to a friction driving roller G. These gears and this movement represent a considerable variable load that the hand wheel has imposed upon it, which would prevent uniformity of speed being applied to the disc F-E.

In the third place, the disc and the differential gearing are driven by tangential frictional contact between the bottom of the disc and a friction roller G.

Such a construction, as is well known, is bound to produce more or less slippage between the disc F-E and the shaft 7. Since the disc F-E is moving in the direction of its radius toward and from the friction roller G, and the friction roller G rotates, the speed of the disc is not uniform, nor is it desired to have it uniform. The only effort is to get uniform linear velocity of the disc F-E, and in my opinion this could not be obtained with the construction shown and described in this patent.

With regard to the second Bell & Tainter Patent No. 341,214, two forms of a recording and reproducing machine are shown. One form in Figure 1, which is substantially in the form described with respect to the first patent in all essentials. So that it is not necessary to repeat the description of it except that in this case the machine has an additional irregular stylus load,

that is, additional friction produced by the bearing of the stylus on the record, which has to be taken care of by the shaft 7, with which the handle is connected.

In Figure 12 a construction is shown in which, instead of moving the disc back and forth with respect to the friction drive wheel G by means of a lead screw, a pivoted arm is arranged in which two sets of worm gearing are provided for producing the motion. This, as I said before, would produce equal if not a greater variable load upon the drive shaft.

Figures 18 and 19 show a modification which defendants' model is supposed to represent. Here again the handwheel driving the shaft 7 is carrying the load of all of the mechanism shown in the machine. The drive is through the tangential contact friction roller G upon the disc Q, and then a vertical shaft P leading down from this disc has two pulleys which are belted to the delivery and windup reels U and T, which are arranged horizontally on vertical shafts, and have considerable friction as they rotate in engagement with flanges 75, all of which constitute irregular load on the drive shaft 7.

I should point out that there are four friction clutches in the system. One placed in each of the reels mentioned, and two placed in connection with the pulleys on the drive shaft to engage and disengage in connection with the driving of the reels. And all of this will result in considerable additional irregular load being placed upon the drive shaft 7 and will cause slippage in the tangential friction drive of the disc G with the disc Q.

Furthermore, these clutches operating on these reels from which the tape is directly drawn and upon which the tape is directly wound in its passage over the disc Q, are bound to cause the tape to slip to a certain degree in its travel over the disc S.

I again call attention to the irregularities set up in defendants' model of the German patent when the film was driven by the holdback sprocket. In the case of Bell & Tainter here the strip on which the record is to be made passes directly from the feed reel over the disc, which drives the strip, and passes direct from this disc to the takeup reel, and the direct coaction of these reels on the tape is bound to create disturbances and irregularities in the speed of the tape past the stylus, producing even worse disturbances than in the case where it was attempted to drive the film in defendants' model of the first German patent by a holdback sprocket.

A strip of waxed paper is proposed for recording by a stylus, which digs into the paper as it passes over the wheel, and it is well recognized that this type of stylus creates varying friction, according to the loudness of the tones to be recorded or reproduced.

The kind of uniform surface speed of the disc as referred to in this patent, in my opinion, is not at all comparable with the uniformity of speed which the patent in suit deals with, because the latter simply could not be produced in this machine as shown and described.

Q. 749. You have made reference in your discussion of the Bell & Tainter patents to the slippage that would result in driving the disc Q by the tangential friction roller G. I refer you to the Jamieson British Patent No. 2814, of 1884, which is also a patent set up by the defendants, and ask you if in that patent you find a friction disc drive, the function of which is to permit slippage with respect to it and one of the two parts it is to frictionally engage.

A. Yes, that is true. There are two friction drives shown in this patent. The friction drive here is a bevel friction drive.

Q. 750. In Figure 3.

A. It is shown in Figure 1 that I was looking at at the time. Figure 3 shows it perhaps more clearly, between the two cones "1" and the flat cone L. As I understand the operation of this machine, both of these drives must slip continuously in order to produce the desired result.

Q. 751. Will you please refer to the Underhill United States Patent No. 995,390, referred to by Mr. Waterman, and state your views as to the disclosure of this patent with reference to the patent in suit.

A. This patent relates to an automatic type of cylinder phonograph, one in which the records are changed automatically and which I understand was employed in certain nickel in the slot machines in the earlier days, where of course the degree of uniformity of speed was not of any great moment.

I think I might start by reading the statement on page 2, line 34 to line 45:

> "A mandrel constructed as described may be relied upon to center the record cylinder with an accuracy sufficient for ordinary purposes, but, if desired, the flanged supports may be made to fit the outer ends of the record cone with a small clearance, such, for example, as five one thousandths of an inch, so that no greater eccentricity can occur than that allowed by such clearance, which I have found negligible, while this allows for the necessary contraction of the record under changes of temperature."

If such eccentricity were allowed with a record of this character, which I assume to be about two inches in diameter, it would mean that there would be a variation in the radius of a record of twice five one-thousandths of an inch, or one one-hundredth of an inch. This, compared with the average radius of the record,

which is one inch, would mean a speed variation of one per cent., which Mr. Underhill apparently thinks is negligible and which he so states. While in the patent in suit it is well known that speed regulation must be maintained down to a small part of this value, that is, a fraction of one per cent.

The machine is quite complicated. I will try to describe the important features. The shaft a4 of Figure 1 carrying the sound record, is connected by a small clutch to a rod suitably connected to sleeve g on which a flywheel is mounted. I point out here that the flywheel is not directly connected to the member carrying the sound record, but is only connected by a clutch engagement. This connection in the clutch and in the mechanism at the end of the rod g3 will set up irregularities in the drive between the flywheel and the sound record, and allow considerable lost motion between the flywheel and the record.

In addition to this, this flywheel is connected on the same sleeve with a pulley g2, which is belted by a belt g′ to a shaft and a number of gear elements, and another clutch shown in Figure 5 for driving the record changing mechanism, and in addition to this, the lead screw for carrying the stylus is driven from the same source. All of these relatively heavy and varying loads affect the flywheel, and the flywheel has to take care of all of them.

It will be obvious from this that the character of uniformity of the shaft carrying the sound record could be nothing comparable with what the patent in suit refers to as a uniformity of movement.

I see nothing in this patent comparable with the patent in suit or with the defendants' apparatus.

On page 6, line 29, it is pointed out that one function of this flywheel is to bring the record up to normal speed promptly as the clutch is thrown in,—the flywheel here serving the same function as that in the Amet patent.

Q. 752. I will ask you to next take up the Edison Patent No. 227,679, referred to by Mr. Waterman, and describe its construction and operation as briefly as possible, as to its construction and use of the flywheel and its operation.

A. This is one of the very early Edison patents, which had not progressed beyond the hand drive stage, and in order to get some semblance of speed uniformity, a flywheel was located on the same shaft that the hand drive actuated to steady and to eliminate some of the enormous speed variations that are always present when it is attempted to drive a shaft by hand.

As Mr. Rankine has pointed out in the text which Mr. Waterman introduced, the flywheel is here placed as near as possible to the source of power and has for its effect the elimination as far as possible of the speed variations in the source of power, which in this case was the hand drive.

Q. 753. Will you briefly refer to the threaded shaft and the stylus and its effect on operation, so far as concerns the uniformity of movement.

A. Mr. Edison recognizes the variable load which the threaded shaft, the stylus and other elements of this apparatus introduce, and attempts to overcome the effect of these variable loads to some extent by the use of the flywheel which is provided.

Q. 754. Will you refer to Edison Patent No. 386,974 referred to by Mr. Waterman.

A. This patent apparently indicates that Edison found the hand drive totally impractical for any useful purpose, and has introduced a very early and crude form of electric motor. This motor has a brass wheel, which is described as having a flywheel effect, and on the periphery of this brass wheel armatures are placed at spaced positions. Magnets are located near the periphery of the wheel, and these magnets give corresponding pulls to the armatures as they pass them.

From the construction of Figure 2, the commutator shown here indicates that the magnets are not energized more than approximately one-third of the time; in other words, the wheel is given a push one-third of the time and coasts for two-thirds of the time, and the drive is a pulsating drive, due to the construction of the electric motor.

It has been tried to eliminate these pulsations by the use of a heavy brass wheel and the force of the pulsations as described in the Rankine text, the flywheel in this case being located directly at the driving motor. The flywheel drives the cylinder through a pair of beveled friction gears, which of course would introduce irregularly of motion, and even though the flywheel and motor were revolving at uniform speed.

There is a further irregular load placed on the apparatus by a stylus pressure, which is not specifically provided for, and would cause irregularities of speed.

Q. 755. Is that friction drive or one of the members described as a soft member in the patent?

A. Yes. My recollection is that the cone shown on the vertical shaft is described as being covered with leather or other similar material.

Q. 756. Does this mandrel shaft in this patent, which I believe is marked F, also carry the feed screw with split nut for producing relative movement between the stylus and the cylinder?

A. Yes. The mandrel shaft also carries the feed screw with its split nut.

Q. 757. Now, will you refer to the next Edison patent set up and referred to by Mr. Waterman, No. 499,879.

A. This patent shows a further refinement and improvement of the original Edison machine. It is driven by a type of electric motor that has fewer speed

pulsations in it. However, the armature of the motor has considerable moment of inertia, and the armature of the motor acts to a considerable degree as a flywheel. The speed of the motor is controlled by a flyball governor, which alternately opens and closes the circuits of the motor. This of course is open to the objection that the applied force of the motor is not constant, but it is turned on only at certain periodic intervals.

The speed governor is depended upon to hold the speed constant in connection with this action on the motor.

Q. 758. Aside from the described means of controlling or attempting to control the speed of the member driving the machine: is there any other speed control provided?

A. There is no other speed control provided, except such flywheel effect, such as it may be, in rotating the armature of the motor.

Q. 759. And does this patent show the characteristic Edison feed screws for the stylus carriage and the usual stylus bearing on the record?

A. Yes, this is exactly the same as the one previous to it in that respect.

Q. 760. Setting up the irregular loads that you have referred to in regard to the other patents?

A. Yes.

Q. 761. Will you now refer to the Edison Patent No. 513,095, referred to by Mr. Waterman.

A. This is a rather interesting patent because it proposes to drive a phonograph with a water motor, which seems rather strange to us today. There is no flywheel provided in this patent, other than the proposed rather small and ineffective inertia of the waterwheel itself, which here seems to be of rather very light construction.

Q. 762. What does Edison rely upon in this patent to control the speed of the machine?

A. Such speed control as may be produced in this machine is due to the action of a flyball friction governor.

Q. 763. Shown at his R-R in Figure 3?

A. Yes, shown at R-R in Figure 3.

Q. 764. And in what manner does that operate to *control the speed, if you know*?

A. When the speed exceeds a given value, the balls fly out and bring two plates into engagement, which produces a friction load of the driving mechanism and tends to slow it down.

Q. 765. Will you next refer to the Berliner Patent No. 534,543, referred to by Mr. Waterman.

A. This is a form of disc phonograph arranged for hand drive. A light hand wheel is shown, which is operated by the crank and which operates through a type of friction drive, the flat disc carrier shown in the drawings. I am now referring to Figure 2. Figure 3 shows the hand drive mechanism consisting of a pulley wheel 80, directly connected with a handle 84, and this in turn is belted to the wheel 77 which rotates the disc record through a friction drive on the same shaft and which is not very well illustrated in Figure 3. It is the conventional form, however.

There is, of course, no possibility of getting anything that approaches uniform speed with such a system, on account of the very serious limitations of hand drive.

Q. 766. Does this patent also embody the same tangential friction drive between the shaft 13 and the rotating disc that you referred to in some of the other patents, such as Bell & Tainter?

A. Yes, it has exactly the same variable loads, and these are impressed upon it as those already described

in the other similar types of equipment. The lead screw, the system of bevel gears, and the load of the recording and reproducing stylus.

Q. 767. What in your opinion would be the possibility of getting, with such a machine, the character of uniform motion of the sound record required for proper sound reproduction?

A. I should say it would be physically impossible to even approach the uniformity of speed which is necessary.

Q. 768. Will you next take up the Jones Patent No. 602,453, and the Jones Patent No. 605,484, referred to by Mr. Waterman.

A. This patent, which is directed to a new type of gramophone needle—I am now referring to the Jones United States Patent No. 602,453—shows an identical type of drive with that illustrated in the Berliner patent previously referred to, and has all of the disadvantages there cited. It is a hand drive, and of course it is impossible to expect even an approximation to constant speed with a hand drive.

Q. 769. Has it also the tangential disc friction drive from the horizontal shaft in the mounting B-3 over to the disc G?

A. Yes, that is present in this patent also, as it was present in some of the previous patents; and of course the same difficulties are present here as were present in these previous patents which I have already discussed.

Q. 770. Will you now refer to the next Jones Patent No. 605,484.

A. This patent is directed toward producing a simple and inexpensive toy machine, and is driven by a spring motor which is in turn controlled by a flyball governor having a friction brake connected with it. The drive is through one of the tangential friction

combinations such as already described and criticized in previous patents, and the governor is connected by an elastic belt to one of the driving members.

This patent points out the utility of the mass of the record carrier for ironing out some of the irregularities of speed, just as it is pointed out in the specification of the patent in suit.

There are many irregularities, of course, in the operation of this device. There is the variable load due to the stylus and irregularities due to the clockwork mechanism, the tangential friction drive and other irregularities; but since it is to be used only for a toy, it is apparently of small moment in the case of this particular apparatus.

Q. 771. I believe the only one of the three Clark patents originally set up, which the defendant is relying upon now is the Clark Patent No. 597,875. Will you please briefly refer to that patent and describe it.

A. In this patent the impossibility of obtaining anything approaching uniform speed by hand drive is definitely recognized, and it is stated on page 1, beginning with line 74:

> "It is impossible for anyone to evenly drive the machine with a small driving wheel and crank handle, which is necessary to produce the best results."

And Clark proposes to use a device which disconnects the record driving mechanism when the crank is turned too rapidly. This being a very crude device, it is not capable of giving anything like the degree of uniformity that would be required for commercial sound reproduction and, in fact, it has no effect whatsoever if the crank is turned at a speed below the necessary speed.

It introduces a bad unbalance in the flywheel which would further set up pulsations in the operation of the machine.

The tangential friction drive is again used here to drive the machine, and that of course would introduce all of the irregularities inherent in that type of drive. It is highly improbable even with the Clark improvement, of anything remotely approaching constant speed being produced.

Q. 772. With reference to various spring drive patents which Mr. Waterman has referred to, I first call your attention to the Holst Patent No. 587,527, and I ask you to briefly review that patent.

A. The Holst Patent No. 587,527 is directed to a kinematographic lantern or apparatus in which it is proposed to move the film without progressing it in intermittent jumps or, as is sometimes known, as a continuous projector.

The takeup reel in this equipment is provided with a spring so that the reel is not rigidly mounted on the takeup shaft, but the drive acts through a spring, this being provided of course to take up the difference in the speed between the required rotation of the reel when it is full of film, and when there is very little film on it. As the film is wound on the takeup reel the diameter of the film becomes larger and larger, and it is necessary to wind it at a slower and slower speed if the film is passing through the projector at constant speed.

I may state parenthetically that is the type of continuous projector with small lenses and large lens shields interposed between which has certain very definite optical limitations and has not come into commercial use to any extent. The picture that can be produced by it is relatively weak and inferior. This equipment has nothing to do with sound records of any character.

Q. 773. Have you stated where the flywheel J there in the drawing is applied? Is it on the driving shaft of the machine, or where?

A. The flywheel j is on the same shaft with a roller v—I think the proper character is—around which the film is passed as it leaves the projector gate and passes on to the takeup reel.

Q. 774. Will you describe what drives the series of lenses over the sprocket wheels, which I believe are marked dd.

A. There is a bevel gear drive to drive the lens combination over the wheels dd, which would of course introduce irregularities of motion to some extent; but if the lenses and the film move through the machine at the same speed, the audience will not be able to detect any difference in the speed of operation in the machine. The requirement is that the lenses and the film move at the same speed, whether that be uniform or pulsating or intermittent.

Q. 775. Are those two wheels dd carrying the large number of lenses shown there on a looped belt or whatever it is, driven from the same shaft as the one on which the flywheel is mounted?

A. Yes.

Q. 776. And what is the load, and the character of the load that that movement would bring upon the flywheel?

A. It would be a variable load, a fluctuating load, due to the irregularities of the mechanism.

Q. 777. Would it be light or substantial?

A. It would be quite substantial.

Q. 778. Will you please next refer to the Momyer Patent No. 1,317,450, referred to by Mr. Waterman?

A. This patent is directed to a motion picture projector of the same characteristics, having some of the same characteristics as that described in the previous patent, that is, it goes by the name of a continuous motion picture projector. There is a flywheel provided on one shaft, but the sprocket that is located on this shaft is not rigidly connected with that shaft,

but is coupled to it by some sort of ratchet mechanism, which can be thrown in or out of operation and which would hold the sprocket tight only in one direction. There is no necessity for absolutely constant speed in equipment of this sort, as I have already pointed out. The only necessity is that the film and the moving lenses must move together. Whether that motion is uniform or non-uniform is of little or no importance, as long as they move together at the same rate. This machine is shown as being driven by hand crank, which is indicative of the fact that speed fluctuations are of little or no importance in its operation.

Q. 779. Will you next take up the Constable Patent No. 1,425,177, referred to by Mr. Waterman?

A. This is a device to be applied to machines intended for cylinder records. It has been found that if the carrier for the cylinder record does not have sufficient mass, that in some cases a spring connection between the driving mechanism may be of benefit, and a particular embodiment of a spring connection is shown in this patent. Figure 2 shows two heavy U-shaped springs pressing against the record carriage, and is described as being so adjusted that the ends of the springs——

Q. 780. I think with regard to the models, the last time you were on the stand you spoke of the spring connections. So do not repeat that. Just state what the character of the machine is: whether cylindrical record, or film drive, or what.

A. I beg your pardon for repeating what I have already said. This is the ordinary type of cylinder record machine, and of course is subject to varied load due to the stylus and the lead screws and various other mechanisms that must be utilized in normal operation of cylinder machines.

Q. 781. Will you please state briefly how the speed of this machine is controlled.

A. The speed is controlled by means of a flyball governor which operates a friction brake.

Q. 782. I next refer you to the group of patents referred to by Mr. Waterman at page 685, taking up first the Gally United States Patent No. 210,249.

A. This Gally patent is directed to a mechanical musical instrument, or in common parlance of today, a hand organ. Two wheels are provided, one of which is directly connected on the operating shaft, and upon this wheel, which is directly connected to the operating shaft, a brake g is provided to press against wheel E. This can be seen in Figure 1 where the brake g is shown in the lower right-hand corner of the picture. As far as I can determine from the description given here, the object is to allow the operator to continuously crank the machine, at the same time holding on to one particular note for alleged musical purposes for a longer period than it is so cut on the record.

In other words, the elastic connection between the two wheels here is not to produce constant speed, but is to allow the machine deliberately to be slowed up by means of the brake and at the same time to allow the driving force acting on the small wheel to be continuously in operation. It is totally different from any apparatus of the patent in that respect.

Q. 783. The patent has nothing to do with sound reproduction or recording?

A. Has nothing to do with sound reproduction further than sound reproduction in a hand organ and, of course, that is widely different from anything that is considered in the patent in suit.

Q. 784. The next patent on the list that you find mentioned is Wood, No. 724,765. Will you briefly state what that patent relates to.

A. This patent recognized the tendency of certain types of alternating current motors, particularly those known as synchronous motors, to produce a periodic

speed fluctuation or, as is sometimes called, to hunt, to produce this hunting, and in order to minimize the effect of this irregular rotation, a flywheel is connected on the far end of the shaft, shown in Figure 1, this flywheel being connected to the shaft through a series of springs and friction devices.

Q. 785. It has nothing whatsoever to do with sound, has it?

A. It has nothing whatsoever to do with sound or pictures or any related art.

Q. 786. Just relates to an ordinary electric motor?

A. Ordinary electric motor to be used for power purposes.

Q. 787. Will you please take up the next patent of the group, Lanchester, No. 1,085,443. First state whether it has any relation to sound recording or reproduction on film, and then just briefly state what it is.

A. This patent has no relation to sound recording on film or to motion pictures or to any of the allied arts. It is directed toward a device which damps out the torsional vibrations in crankshafts.

Q. 788. Of what?

A. Particularly of automobile engines. Most modern cars have some of those Lanchester devices supplied. It does not take the place of a flywheel because, as your Honor will see, a flywheel is provided on the lower end of Figure 1, in addition to the vibration damper which is supplied at the upper end of the crankshaft shown in Figure 1.

Q. 789. Will you next take up the Ebling Patent No. 1,255,143; first stating whether it relates to sound on film recording or reproduction, and then briefly state what it shows.

A. Figure 1 of the Ebling patent shows a crank drive for motion picture projectors. There is to the right-hand part of Figure 1 shown a spring connec-

tion between the crank and the operating shaft of the motion picture projector, and to the left-hand side a flyball governor is arranged to prevent the crank from being turned too fast. At the same time, when the flyball governor comes into action, a bell is rung down in the manager's office, to inform him that the operator is trying to push the film through too rapidly and get through with the show before the required time.

This figure indicates the possibility of operating motion picture films at almost any speed, without the audience knowing any particular difference.

Figures 2 and 3 show modifications of the details of the apparatus described in Figure 1, and Figure 7 shows a combination of a disc record with a hand-driven picture projector. Of course, the disc record has not the possibility of operating at any more uniform speed than that which is given to operate the picture projector; and that of course may vary over extremely wide limits.

There is no flywheel directly connected with the record carrier, or other means of maintaining constant speed, except of a small flywheel governor being shown, somewhat indistinctly, which may have a tendency to keep the apparatus from being driven too fast, but it does not provide any means for maintaining the speed up to the proper value.

Q. 790. That is, the spring is shown there simply to keep the machine from being driven too fast?

A. As far as I know, that is the function of the spring shown at 42 in Figure 7.

Q. 791. The next patent referred to by Mr. Waterman was patent to Roland No. 691,667. Will you please state briefly what that patent relates to, whether it has anything to do with sound on film recording or reproduction, and briefly what it describes; and whether it has resilient or spring drives which it is alleged to have by Mr. Waterman.

A. This patent is for a synchronous telegraph system. We would describe it today as a printing telegraph. There is no mention or illustration of any spring or resilient drive in this patent.

Q. 792. And it says nothing about sound recording or reproduction on film?

A. It has nothing to do with sound recording or reproduction or film or motion picture film or any similar system.

Q. 793. I next refer you to the Jamieson British Patent No. 2,814 of 1884, referred to by Mr. Waterman in this group. This is the patent that you already mentioned in connection with the friction drive, and I will ask you to state briefly what the subject of that patent is, whether it relates to a sound recording recording or reproduction or sound on film system, or to film movement, and just briefly what it shows.

A. The patent is for improvements in electric connections, and it shows a complicated system of varying the speed of the prime mover, which is apparently driving an electric generator; so that when additional load is thrown on the electric generator, the voltage does not drop off, and the lights dim down. It has nothing to do with sound, has nothing to do with film, has nothing to do with motion pictures.

Q. 794. And what is the spring there used for?

A. The spring here is used to allow the copper disc D shown in Figure 1 to slow up relatively with the motion of the driving pulley, and thereby control the throttle opening or its equivalent in the driving engine which propels the electric generator.

Q. 795. I next refer you to the Baron British Patent No. 21,371 of 1898, referred to by Mr. Waterman in this group, and ask you to state briefly whether this patent relates to sound on film recording or reproduction, and to what the patent does relate, and briefly describe the construction.

A. This patent relates to a combination of some type of special picture recorder, with a device for reproducing and recording the sounds which may occur at the time the pictures are taken. I am at a complete loss to know what the nature of the picture recorder is, because it is stated in a number of places in the specification that the size of the photograph is two one-hundredths of a centimeter, which would mean that one of the dimensions of the photograph was seven one-thousandths of an inch. Never having seen photographs of that character, I am at a loss to know what the camera is used for. The camera is driven by hand, and through an electrical connection, operates on an electric motor which in turn is geared with a cylinder phonograph.

The motor is of the pulsating type, as described in one of the early patents, that is, the pull of the motor is not uniform, but the motor operates by jerks, and in order to eliminate these jerks to a limited extent from acting upon the phonograph cylinder, a spring connection is provided between the motor armature and a flat plate which is connected to the driving mechanism for the phonograph.

This is shown in Figure 7, the flat plate being 13 and the springs designated by 14.

Q. 796. Is this disc member, apparently 13, referred to as a flywheel on the shaft of the sound recorder or reproducer, or how is it connected with that shaft?

A. According to the illustration in Figure 7, it is only a flat thin plate, which of course would have a relatively small moment of inertia, and this flat plate 13 is connected to one of a pair of bevel gears, and with this bevel gear connected to the plate 13 is meshed a second bevel gear 17, which drives the phonograph cylinder, and a third bevel gear 18 which operates the feeding mechanism. Bevel gears are notorious as

far as irregularities of motion are concerned, so that even should the plate 13 have uniform motion the bevel gears would probably introduce irregularities in the movement of the phonograph cylinder.

Q. 797. That bevel gear arrangement is interposed between this so-called flywheel and the mandrel carrying the sound record?

A. That is true.

Q. 798. And is that shown in the machine carrying the lead screw for the phonogram carriage also driven through those bevel gears?

A. Yes.

Q. 799. What would be the extent of the irregular load applied on the so-called flywheel by these arrangements that you have referred to?

A. It would be quite considerable. It is to be understood that since the motion picture equipment is driven by a hand crank, and the phonograph is controlled by the rotation of the hand crank on the motion picture machine, that constancy of speed is of course out of the question.

Q. 800. You referred to the pulsating character of the electric motor as referred to in some earlier patent. Did you have reference to one of the Edison patents you have described?

A. Yes. The Edison Patent No. 386,974.

Q. 801. In this group I next refer you to the French Patent No. 414,788, mentioned by Mr. Waterman, and ask you to state briefly the subject matter to which this patent relates and the construction of the same.

A. This patent is for an installation for electric drive for disc carrying plates in phonographs, and shows an arrangement whereby the plate carrying the disc records of the Victrola type is driven with a small motor m shown to the right of Figure 1. The speed is controlled by means of a flyball governor k shown

also on Figure 1, and the record carrying plate is made of particularly heavy construction as indicated in Figures 3, 4, 5 and 6.

Q. 802. Does it relate to sound on film recording or reproduction?

A. It has nothing to do with sound on film or motion picture recording or reproduction.

Q. 803. Has it a resilient or spring drive?

A. It does not have what I consider to be a resilient or spring drive.

Q. 804. It simply shows a belt drive?

A. A Belt drive.

Q. 805. I next refer you to the French Patent No. 10,377, and ask you to state briefly what that patent relates to and its construction.

A. This is a patent of addition to a previous French patent, and relates to the use of so-called damped spring for driving a phonograph disc carrier.

Q. 806. Does it relate to sound on film recording or reproduction?

A. It has nothing to do with sound on film recording or reproduction or any kind of film picture or otherwise.

Q. 807. The drawings do not seem to show the application of the springs BB in Figure 1 to the device. Do you know where the springs are applied?

A. As I understand it, they are applied between the driving mechanism and the flat record carrier plate.

Q. 808. Mr. Waterman has referred to a group of patents bearing on the arcuate bending of the film over a roller, and before you take this up, I will ask you to refer to the patent in suit, with particular reference to Claim 9, which brings in this idea, and state what is the advantage of the arcuate bending as set forth in that claim with relation to the particular sys-

tem of recording or reproducing of sound on film of the patent in suit.

A. As has been already pointed out, the arcuate bending of motion picture film with sound records is of particular importance in that it overcomes the tendency which is always present in photographic film, for the film to curl in one direction or the other, that is, either latitudinally or longitudinally. This effect has been known for many years and is due to the shrinking action of the photographic emulsion on one side of the celluloid after it has thoroughly dried out.

Q. 809. Just what is the disadvantage in connection with the system of the patent in suit, if that is permitted, at the translation point? Just state it briefly.

A. If the transverse bending of the film is permitted at the translation point, the line of light will not be in focus, or more correctly, the entire length of the line of light will not be in focus if the film is curved transversely.

Q. 810. The first patent of this group that Mr. Waterman referred to, I believe, is the Edison British Patent No. 1,644, of 1878, which you have already referred to this morning. Will you please turn to that patent on this point and state whether it discloses a system of film which has the disadvantages of the system of the patent in suit if it were not bent arcuately.

A. There is no type of photographic sound record described in this early Edison patent. There are some types of strip record proposed, such as that illustrated in Figure 33, and which in the specifications is described as a strip of steel. With a steel strip there is no photographic emulsion on either side, and there would be no tendency for warping in one or the other direction.

Q. 811. Is the character of recording or reproduction as shown in this British patent, that is, by stylus, in such a system is the longitudinal buckling of the strip in the manner you have described, similarly detrimental to such recording as it is to recording by a light line as shown in the patent in suit?

A. It has very little effect, because the stylus is usually flexibly mounted and allowed to rest upon the record strip, and rise or fall with any irregularities in the record strip itself, so that this question of focussing the line of light and keeping the film in exact focus does not enter in any degree whatsoever with apparatus such as is shown in Figure 33 or Figures 57 and 58, which also indicate some type of strip record.

Q. 812. That is, in the stylus recording you are dealing with the point at any moment rather than with a line across the film?

A. That is true, and the point may rise and fall to conform to the record as it passes over a roller.

Q. 813. Will you please refer to Bell & Tainter patent No. 314,214 that Mr. Waterman lists in this group and which you have already referred to this morning, and just briefly comment upon that patent, as to whether it embodies the same problem as is embodied with the type of recording of the patent in suit, and which would be obviated by this arcuate bending.

A. Referring to Figure 18, I understand that the record to be used is a waxed paper record, consisting of paper with a waxing or amorphous coating of some slightly adhesive substance. The effect here of course will not be present as it is in the case of the patent in suit. There is little or no tendency toward bending, as there would be in a photographic film.

Q. 814. You mean bending longitudinally?

A. Latitudinally across the short dimension. And should the record have a tendency to ride up slightly

on the drum, it would be taken care of by the flexible mounting of the diaphragm, which must be mounted in such a way as to move in and out from the record.

Q. 815. That is, you are referring to the stylus diaphragm?

A. The stylus diaphragm and its connected stylus.

Q. 816. And in this Bell & Tainter patent, they are using a point for recording instead of a line of light?

A. That is true.

Q. 817. So there would be nothing to get out of focus there?

A. That is true.

Q. 818. Will you next refer to the Pedersen British patent which he lists on this subject and to which you have already referred this morning? In connection with that Pedersen patent, will you point out whether any arcuate bending of the film is shown and also whether the recording method there shown is one which would be affected in some way, as in the patent in suit.

A. There is no arcuate bending of the film shown in the Pedersen patent. It is neither indicated in the drawings nor is there any mention of it in the specifications, and I have assumed that the film in passing over these rollers lies tangentially to the rollers, much in the same way that it is shown in the United States patent to Cawley, No. 1,825,439. This tangential contact through the sprocket 49 is shown to the extreme right of Figure 1.

Q. 819. What have you to say with regard to the type of light recording in Pedersen, on this point?

A. Pedersen employs a point of light for making his records, and it is necessary to maintain this point within very narrow limits, if a record is to be made which can be reproduced by a stylus, hence the question

of the keeping any considerable length of the film element in focus on the sprocket does not enter into this case.

Q. 820. You mean the length transverse to the film which would be occupied by the line of light as used in the patent in suit?

A. Yes.

Q. 821. The next patent referred to is the patent to Bock, in this group, No. 364,472.

A. The Bock patent No. 364,472 shows a highly imaginative system of sound recording. The record shown in Figure 2 as being that produced by the apparatus on Figure 1 is quite obviously incorrect, and this in some respects resembles the type of recording which is attempted in the Pedersen British patent, except that means are obviously not provided to accomplish any such result. The reproduction system shown in Figure 4 would be totally inoperative on a record made with the equipment in Figure 1. Since the point of light only is used, the question of maintaining the film in the focus over the entire lateral width of the film, does not enter into this case.

Q. 822. You mean the entire lateral width of the film, or the part carrying the sound record?

A. The part carrying the sound record.

Q. 823. And will you state whether or not in this Bock patent there is any provision for uniform motion of the film, and state just how the film is progressed?

A. I have never been able to understand how the film is progressed—whether the film is driven by the cylinder b, or is taken up by the roller a. Obviously if it is driven by the cylinder b, it cannot be rolled up by the roller a, because they are moving in relatively the same motion, and the film is wound around them in opposite directions. Some statement is made, beginning with line 96, that the record passes around and

is moved by the drum or cylinder b which is rotated at a uniform speed by the clockwork or other motor c. I take this to mean that uniform speed refers to non-intermittent speed.

Q. 824. If it were driven by the drum b, but pulling the strip a directly from one of the rollers aa, would you be able to get the amount of uniform speed that the patent in suit and the defendants contemplate?

A. No, there is no means for providing uniform speed on the driving mechanism, as far as I can determine, and of course irregularities would still further prevent such a goal from being reached.

Q. 825. And if the film were driven by either one of the reels aa, what would be the character of the speed of the film over the drum?

A. It would be a non-uniform speed, increasing with time. As the roller a became larger in diameter, the speed of the film would increase also.

Q. 826. The next patent referred to in this group, or an additional group on page 686 by Mr. Waterman, is the Oxley patent No. 458,916. Will you please take that patent and state the character of the recording there, and whether it involves the problem that the patentees seek to solve on this idea of arcuate bending, and also state whether the uniform speed of the film could be obtained by the arrangement there shown.

A. This is another of the wax type of records which is supposed to be engraved by means of the vibrating diaphragm shown in Figure 2. The wax record having none of the characteristics of photographic film, does not involve the same problem as in the present patent in suit, and irregularities in focussing are taken care of by the freedom of motion which the recording stylus had.

Q. 827. Do you mean that there is any focussing there or any irregularities that might occur by reason of the film curling?

A. There is no focussing here, of course, but it is a mechanical stylus, and should the wax coating be thicker on one part of the record than on another part, as seemed to be the case in the original Bell & Tainter apparatus, the stylus would be allowed to rise or fall on account of its elastic mounting on the diaphragm.

Q. 828. And being a stylus point recording system, would it contain the problem of the patent in suit?

A. No, it would not. There is no provision for uniform motion in this system, because the film is driven by being wound up by clockwork on one of the supply reels, which would mean that the film would progress at a constantly increasing rate of speed.

Q. 829. And is the strip, whatever it is, pulled directly from one of the rewind reels across the drum C to another?

A. It is.

Q. 830. And you have already pointed out that such an arrangement would produce irregularities in speed?

A. Yes.

Q. 831. Will you next refer to the Randall patent in evidence in this group, No. 502,382?

A. This is another stylus type of strip record, and resembles in many respects those which have been considered previously. The strip is fed off the supply reel 33 of Figure 2, and around a roller, to the roller 8, at which point the record is made. The record is here made by engraving, and with a moving stylus, of the hill and dale type of recording, and constancy of speed is attempted by means of a flyball governor 48.

Q. 832. Where is that governor attached?

A. The governor is driven from a friction drive which is attached to the main drive shaft 3. The drive shaft in this case being driven by a hand crank, and of course the limitations are such that constant speed could not be maintained with the hand drive.

Q. 833. And for the reasons already stated, you have a point recording system which would not involve the problems of the patent in suit?

A. That is true.

Q. 834. The next patent referred to in this group by Mr. Waterman is Cooley No. 551,946. Please briefly refer to that.

A. The Cooley patent is a totally inoperative system, which shows immediately that the inventor had no idea of the problems that this case involved. First, in Figure 1, a diaphragm is shown connected with a long lever C, and the inventor thinks that by speaking into the diaphragm the lower end of the lever C may be made to cut out a pattern on a moving strip of paper, or otherwise produce a sound record of other type. This of course is obviously impossible.

Q. 835. Assuming for the sake of argument that it might be cut: is it a point recording system such as you have referred to in some of these other patents?

A. Partially yes and no. It is a point recording system, and the inventor may use this line as a line of separation between the two halves of the record, and discard one or the other half of the record, and use but part of the record for reproduction.

Q. 836. Apparently, where the arcuate or alleged arcuate position of the strip is shown, is in Figure 3. Will you please refer to that and state what the construction and operation is.

A. This is a device for reproducing the record by means of suction or pressure. The record has half of it removed, and half is allowed to pass in front of the orifice f4, and by either pushing up or pressing down upon the collapsible tank marked K, suction or air pressure is produced, which in some way reacts upon the diaphragm G and reproduces certain pulses.

Q. 837. Is that an operative structure, in your opinion, for reproducing sound?

A. To my mind it is completely inoperative for the purpose of reproducing sound.

Q. 838. And is anything shown in the way of attempted uniform speed of the film past that translation point?

A. Drive mechanism is not shown, nor is any great stress laid upon the speed at which the film is recorded or reproduced.

Q. 839. Will you next refer to the Ader patent No. 565,567 of this group?

A. The Ader patent No. 565,567 is directed to a phonographic telegraph recorder, and by moving a wire back and forth in front of an opening, a small elongated opening R, a record of the shadow of this wire is made on a sensitized moving strip.

Q. 840. Is there anything stated or shown with respect to moving the strip at uniform speed over the roller?

A. The speed of movement is obviously quite slow, because it must be slow enough to develop the strip as it passes through the three development tanks shown to the right of the Figure 5. There would be no advantage one way or the other in having exactly constant speed, or a variation from constant speed. The telegraph signals would be relatively unaffected in either case.

Q. 841. And does it relate to sound on film recording or reproduction?

A. It does not.

Q. 842. The next item in this group is a patent to Holman No. 939,692. Will you please briefly refer to that.

A. The Holman patent is directed to a special type of flexible band phonograph. It is illustrated in Figures 1 and 2, and comprises a stylus engraved record on a long continuous band of considerable width. The

patentee says that he may use such a length of belt as to correspond to a virtual diameter of 36 inches, with the width of six inches.

Q. 843. And does this also involve the point recording with stylus that you pointed out in the other patents?

A. Yes, it does. It involves the point recording by stylus.

Q. 844. The next patent is Chabeault, No. 1,135,436. Will you please briefly refer to that patent.

A. This patent is for a telephonograph, a device for picking up sounds of low intensity by means of a series of relatively sensitive microphones, and provision also for reproducing such sounds at a distance perhaps, or in some cases near by the original source, by means of special types of telephone receivers.

Q. 845. State the character of the recording or reproduction, and whether the apparatus shown is one which would give uniformity of speed as embodied in the patent in suit or the defendants' structures.

A. The drive mechanism to progress the sensitized strip is not described, so that it is uncertain as to what the speed of recordation is. The sound is recorded by a moving point of light similar to that proposed in the Pedersen British patent, and a stylus record made by the gum bichromate process, which is to be reproduced mechanically. There is very little description of the system used for recording the sound.

Q. 846. Is the recording by stylus?

A. No, the recording is not by stylus. The recording is by vibrating a tiny point of light on the film to produce a record which may later be turned into a stylus type record.

Q. 847. And that point of light record, as in Pedersen, does not involve the problem of the patent in suit, as to focus?

A. No, it does not.

Q. 848. And could the record made be reproduced by light?

A. The record cannot be reproduced by light. The patentee uses in this case the expression "uniform speed," as distinguished from intermittent speed in the normal type of picture cameras and projectors.

Q. 849. And so far as any mechanism is shown with respect to supporting and moving the film, it consists of two reels, one from which the film is drawn, and one on which the film is wound up, with two guide rollers 7 and 7, on each side of the drum over which the film is pulled: is that right?

A. That is true.

Q. 850. The next patent of the group is the Andersen Patent No. 1,246,217. Will you please refer to that.

A. The Andersen patent relates to a motion picture machine for projecting pictures, in which the film moves continuously, as distinguished from intermittent motion in the normal type of picture machine. The device is driven by a crank 13.

Q. 851. Hand crank?

A. Hand crank 13.

Q. 852. And what is the large cam shown at the right-hand side of Figure 1?

A. The large cam shown at the right-hand side of Figure 1 serves to co-operate with appropriate levers to move the lenses back and forth, so that they follow along with the appropriate picture which they are intended to transmit.

Q. 853. And is this driven from the hand crank also?

A. Yes. And connected with the hand crank through mechanical connections.

Q. 854. In your opinion, is it possible to get uniform speed of the character of the patent in suit, and

which the defendants' machines deal with in this machine?

A. It is not. There is no necessity of uniform speed of any such type required in the present suit and, if such speed were attained, it would have no appreciable effect on the projection of the picture.

Q. 855. And does the patent deal with sound recording or reproducing or sound on film?

A. The patent has nothing to do with sound recording or reproduction.

Q. 856. The next patent of the group is Terwilliger No. 1,256,613. Will you please briefly refer to that patent and state what it refers to, whether it involves any sound on film recording or reproduction, and how the film is driven.

A. The inventor seems to think that a motion picture film may be projected when bent into cylindrical form at the picture gate. It has been known for many years that with ordinary types of lenses that it is necessary to keep the picture as flat as possible, and any departure from the flat condition throws the film out of focus on the screen. But this inventor has deliberately curved the film at the picture gate, thus throwing it completely out of focus on the motion picture screen. It has nothing to do with sound reproduction or sound on film.

Q. 857. Merely a motion picture machine with a curved gate?

A. Merely an attachment for the existing motion picture machine.

Q. 858. And embodies, you say, a fallacious idea for that purpose?

A. That is true.

Q. 859. And is any means shown for uniformity of movement of the film through the machine?

A. In all probability the film would move at intermittent motion. It certainly would, if applied to con-

ventional types of projecting picture apparatus, as the patentee mentions in lines 12 and 13 of the patent, page 1.

Q. 860. The next patent is the Albers Swiss Patent No. 85,751. Please refer to that and state to what it relates and the character of the recording.

A. This is another system in which sound is recorded on a strip record by means of a mechanically vibrating stylus. The particular point of this patent is that the record is run under the stylus, first in one direction from one end to the other, and then the stylus is moved to a slight amount, and the record runs back. This is continued until the beginning of the record is reached, and the process reversed. Obviously, if the record is reversed, the motion of the film cannot be uniform, because it must stop and go back and forth at the end of each one of the sound records, and there are many contributory causes in this apparatus which would prevent any close speed control in the equipment.

Q. 861. The next patent that Mr. Waterman referred to was the Duddell British Patent No. 24,546 of 1902, and he apparently referred to that patent with reference to light-responsive apparatus. Will you please refer to that patent and discuss it.

A. Duddell proposes the use of the selenium cell or other apparatus sensitive to light for reproducing the fluctuating light from the sound record, and further states, line 32, page 1, that its variations are reconverted into sound as in the well-known Graham Bell photophone. There were several alternative schemes proposed in the Graham Bell photophone, one of which involved the thermal effect of the light to expand certain materials and produce sound by expanding the air in a closed container, as one of the systems.

The use of the selenium cell was known at the time of the Bell photophone, and it has been known that there are a number of other combinations which are

sensitive to light action from an electrical standpoint. Many of the compounds of thalium are light-sensitive, and practical application has been made of this principle in the Case thalafide cell. There is a long list of materials which are sensitive to light in much the same way that selenium is, and which in my estimation were proposed for use by Duddell.

Q. 862. In connection with this patent, Mr. Waterman referred to the specification at page 4, line 3, where it mentions the use of a "selenium cell or other photoelectric apparatus," being used, and states in connection with it that the only other suitable photoelectric apparatus that he knows of would be to make use of the photoelectric effect, namely, the photoelectric cell. Do you agree or disagree with that?

A. I think the intent of this statement is quite clear. In line 33, on page 4, he refers to a selenium cell or other photoelectric apparatus. The author here evidently classifies the selenium cell as one type of photoelectric apparatus, and this was a very frequent loose way of referring to light-sensitive equipment as of the time when this patent was issued.

Photoelectric does not refer to any equipment which operates due to the production of electrons on a sensitive surface, but merely is a generalized term to cover equipment which was sensitive to light.

Q. 863. Is it your opinion that he is referring here to a photoelectric cell where he says "other photoelectric apparatus"?

A. I am quite sure that he is not referring to a photoelectric cell in the sense that we use the term today, because if he had employed a photoelectric cell, the equipment was not available to have made any use of it at all. Amplifiers were not known this early in the art, and it would have required some kind of amplifier to have used a photoelectric cell.

Q. 864. And you have testified that in your opinion other photoelectric apparatus was known.

A. Oh, yes.

Q. 865. With respect to uniform speed, will you refer to line 36 of the patent at page 4.

A. (Reading): "The record is caused to travel by winding it steadily from one of the drums D, D′ to the other, at approximately the same speed as used in making the record."

Q. 866. Could you obtain any reasonable approach of the uniformity of speed such as proposed in the patent in suit or the defendants' structure, by winding the strip from one reel to the other, as stated there?

A. No. For the reasons which I have already explained, such uniform speed as required in the patent in suit would be entirely beyond the capabilities of the apparatus.

Q. 867. I next refer you to the Langmuir Patent No. 1,273,627.

MR. WARD: Your Honor, after the demonstration the other evening which your Honor attended we gave opportunity to the experts to examine our machines, and with respect to the machine embodying the Figures 5 and 6 of the patent, their engineers, from what they said among themselves at that demonstration, seemed to think that because we used some gears for driving that machine, that one of the parts of the machine was thereby thrust against another part, which they seemed to contend created some damping action, and without in any way dignifying their contention or seeming to, in order to eliminate any possible quibbling on the point, Professor Ballard immediately ordered another set of gears cut. They are here now and we tender them a demonstration this evening to show that the machine operates just as

well without the gears that they criticized,—I don't suppose that your Honor cares to attend this demonstration,—and will take our word for what happens?

THE COURT: Yes. We will adjourn now until tomorrow morning at nine-thirty.

IT IS STIPULATED AND AGREED that the photo-electric cell application of Vogt, Engl and Massolle, No. 458,626, pending in the United States Patent Office, Exhibit 8, is involved in a three-party interference, the filing date of one of the parties being August 16, 1920, and the filing date of the other party being December 27, 1922.

MR. HASELTON: I offer in evidence Plaintiffs' Exhibits for identification 41 and 42 respectively, comprising photographs of the Bell & Tainter machine in the Smithsonian Institution in Washington, and ask that they be marked as Plaintiffs' Exhibits 41 and 42 in evidence, respectively.

(Received in evidence and so marked.)

MR. HASELTON: I offer in evidence three photographs of a Bell & Tainter machine in the Smithsonian Institution in Washington of a type corresponding generally to Figure 1 of the Bell & Tainter Patent No. 341,214, as Plaintiffs' Exhibits 47-A, 47-B and 47-C.

IT IS STIPULATED AND AGREED that the photographs 47-A, 47-B and 47-C, are photographs of a Bell & Tainter machine in the Smithsonian Institution.

MR. ASHTON: The lack of objection to these photographs shall not be taken as an admission that the machine shown in these photographs is the same as any particular figure of the Bell & Tainter Patent No. 341,214.

(Photographs of type corresponding generally to Fig. 1 of Bell & Tainter Patent No. 341,214 machine in the Smithsonian Institution, received in evidence and marked Plaintiffs' Exhibits 47-A, 47-B and 47-C.)

MR. HASELTON: I offer in evidence an article by Dr. Johannes Rolle, in the Licht Bild Theatre Besitzer, entitled "The Film as a Carrier of Sound Waves," in No. 49 of the 1922 issue of this magazine, pages 6 to 9, together with translation of the said article, and I ask that a photostat of this exhibit be substituted, inasmuch as this original was taken from the records of the District Court in Delaware.

MR. ASHTON: The same objection is made to this publication that has been made by the plaintiffs to publications of the defendants respecting published articles.

(Received in evidence and marked Plaintiffs' Exhibit 48.)

MR. HASELTON: I offer in evidence a copy of the Hoxie Patent No. 1,756,864, previously marked for identification as Plaintiffs' Exhibit for Identification 38.

(Received in evidence and marked Plaintiffs' Exhibit 38.)

MR. HASELTON: I offer in evidence copy of patent to Bardy No. 1,258,298, previously marked for identification as Plaintiffs' Exhibit for Identification 40, and ask that the same be marked Plaintiffs' Exhibit 40 in evidence.

(Received in evidence and marked Plaintiffs' Exhibit 40.)

MR. HASELTON: I offer in evidence copy of the Heisler Patent No. 1,758,832, as Plaintiffs' Exhibit 49.

(Received and marked Plaintiffs' Exhibit 49.)

MR. HASELTON: I offer in evidence copy of Heisler Patent No. 1,768,403, and ask that the same be marked Plaintiffs' Exhibit 50.

(Received and marked Plaintiffs' Exhibit 50.)

MR. HASELTON: I offer in evidence copy of Kellogg Patent No. 1,780,681, and ask that the same be marked as Plaintiffs' Exhibit 51.

(Received and marked Plaintiffs' Exhibit 51.)

MR. HASELTON: I offer in evidence copy of Heisler Patent No. 1,808,551, and ask that the same be marked as Plaintiffs' Exhibit 52.

(Received in evidence and marked Plaintiffs' Exhibit 52.)

MR. HASELTON: I offer in evidence file wrapper of Steiner Patent No. 1,817,781, previously marked for identification as Plaintiffs' Exhibit 36 for Identification, and ask that the same be marked Plaintiffs' Exhibit 36 in evidence.

(Received and marked Plaintiffs' Exhibit 36.)

MR. HASELTON: I offer in evidence copy of patent to Steiner No. 1,817,781, previously marked for identification as Plaintiffs' Exhibit for Identification 35, and ask that the same be marked Plaintiffs' Exhibit 35 in evidence.

(Received and marked Plaintiffs' Exhibit 35.)

MR. HASELTON: I offer in evidence copy of patent to Kellogg, No. 1,827,588, and ask that the same be marked as Plaintiffs' Exhibit 53.

(Received and marked Plaintiffs' Exhibit 53.)

MR. HASELTON: I offer in evidence File Wrapper and Contents of patent to Heisler, No. 1,831,-562, and ask that the same be marked as Plaintiffs' Exhibit 54.

(Received and marked Plaintiffs' Exhibit 54.)

MR. HASELTON: I offer in evidence copy of Heisler Patent No. 1,839,151, and ask that the same be marked as Plaintiffs' Exhibit 55.

(Received and marked Plaintiffs' Exhibit 55.)

MR. HASELTON: I offer in evidence File Wrapper and Contents of Taylor Patent No. 1,847,636, and ask that the same be marked Plaintiffs' Exhibit 56.

(Received and marked Plaintiffs' Exhibit 56.)

MR. HASELTON: I offer in evidence copy of Maurer Patent No. 1,891,388, and ask that the same be marked as Plaintiffs' Exhibit 57.

(Received and marked Plaintiffs' Exhibit 57.)

MR. HASELTON: I offer in evidence File Wrapper and contents of patent to Page, No. 1,892,218, and ask that the same be marked as Plaintiffs' Exhibit 58.

(Received and marked Plaintiffs' Exhibit 58.)

MR. HASELTON: I offer in evidence copy of patent to Kellogg, No. 1,892,554, and ask that the same be marked as Plaintiffs' Exhibit 59.

(Received and marked Plaintiffs' Exhibit 59.)

MR. HASELTON: I offer in evidence copy of patent to Robinson No. 1,880,106, and ask that the same be marked as Plaintiffs' Exhibit 60.

(Received and marked Plaintiffs' Exhibit 60.)

MR. HASELTON: I offer in evidence File Wrapper and Contents of Cawley Patent No. 1,878,577,

Serial No. 357,259, filed April 23d, 1929, and ask that the same be marked as Plaintiffs' Exhibit 61.

(Received and marked Plaintiffs' Exhibit 61.)

MR. HASELTON: I offer in evidence File Wrapper and Contents of Cawley Patent No. 1,594,662, Application filed as Serial No. 328,299, alleged to have been filed October 3, 1919, and ask that the same be marked Plaintiffs' Exhibit 62.

(Received and marked Plaintiffs' Exhibit 62.)

MR. HASELTON: I offer in evidence certified copy of full sized drawings as originally filed October 3d, 1919, in the said Cawley Application No. 328,299, and ask that the same be marked as Plaintiffs' Exhibit 63.

(Received and marked Plaintiffs' Exhibit 63.)

MR. HASELTON: I offer in evidence File Wrapper and Contents of Cawley Patent No. 1,420,304, application for which was filed December 13, 1919, Serial No. 344,708, and ask that the same be marked as Plaintiffs' Exhibit 64.

(Received and marked Plaintiffs' Exhibit 64.)

MR. HASELTON: I offer in evidence certified copy of File Wrapper and Contents of Cawley Patent No. 1,698,536, application for which was filed July 21, 1923, Serial No. 653,704, and ask that the same be marked as Plaintiffs' Exhibit 65.

(Received and marked Plaintiffs' Exhibit 65.)

MR. HASELTON: I offer in evidence certified copy of File Wrapper and Contents of Cawley Application No. 1,816,360, application for which is alleged to have been filed January 8, 1921, Serial No. 435,983, and ask that the same be marked as Plaintiffs' Exhibit 66.

(Received and marked Plaintiffs' Exhibit 66.)

MR. HASELTON: I offer in evidence certified copy of File Wrapper and Contents of Cawley Patent No. 1,825,439, application for which was filed September 16th, 1929, Serial No. 393,072, and ask that the same be marked as Plaintiffs' Exhibit 67.

(Received and marked Plaintiffs' Exhibit 67.)

MR. HASELTON: I offer in evidence certified copy of File Wrapper and Contents of Cawley Patent No. 1,825,441, application alleged to have been filed January 8th, 1921, Serial No. 435,984, and ask that the same be marked as Plaintiffs' Exhibit 68.

(Received and marked Plaintiffs' Exhibit 68.)

MR. HASELTON: I offer in evidence certified copy of File Wrapper and Contents of Cawley Patent No. 1,825,438, application filed September 16th, 1929, Serial No. 393,071, and ask that the same be marked as Plaintiff's Exhibit 69.

(Received and marked Plaintiffs' Exhibit 69.)

MR. HASELTON: I offer in evidence certified copy of assignment as recorded from Cawley to Radio Corporation of America, recorded in the United States Patent Office, Liber R/140, page 318 of Transfers of Patents, and ask that the same be marked as Plaintiffs' Exhibit 70.

(Received and marked Plaintiffs' Exhibit 70.)

MR. HASELTON: I offer in evidence certified copy of assignment from Cawley to Radio Corporation of America, recorded in Liber R/140, page 315 of Transfers of Patents, and ask that the same be marked as Plaintiffs' Exhibit 71.

(Received and marked Plaintiffs' Exhibit 71.)

MR. HASELTON: I offer in evidence assembly from Radio Corporation of America, PS1 apparatus, comprising a gear plate and two springs removed from flywheel assembly, and ask that the same be marked as Plaintiffs' Exhibit 72.

(Received and marked Plaintiffs' Exhibit 72.)

IT IS STIPULATED that Plaintiffs' Exhibit 72, just offered in evidence, is similar to the said assembly in the alleged infringing PS1 machine.

MR. HASELTON: I offer in evidence sample Simplex takeup sprocket, being a 16-tooth sprocket, and ask that the same be marked as Plaintiffs' Exhibit 73.

MR. ASHTON: No objection, but I call attention to the groove between the teeth on the sprocket.

(Received and marked Plaintiffs' Exhibit 73.)

MR. HASELTON: I offer in evidence a motion picture film sprocket, 32-teeth, at each edge, for the purpose of showing the approximate diameter of a 32-tooth sprocket in which the teeth are of standard spacing, and ask that the same be marked as Plaintiffs' Exhibit 74.

(Received and marked Plaintiffs' Exhibit 74.)

WILLIAM C. BALLARD, resumed the stand.

DIRECT EXAMINATION (Continued.)

By MR. WARD:

Q. 868. Professor Ballard, we left off with the Langmuir patent. I now refer you to the Langmuir Patent No. 1,273,627, referred to by Mr. Waterman, and ask you please to state as briefly as you can the

object of the vacuum tube circuit in that patent, the stated use of the circuits, and whether the circuits are adapted for use with PE cells for sound reproduction.

A. The Langmuir Patent No. 1,273,627 is directed to a method of and means for controlling electric currents or potentials. As one source of electric current, a photoelectric cell is used, it being illustrated in such relation as it would appear for use in photometric measurements as distinguished from sound reproduction uses. The patentee, in line 18, page 1, states:

> "In one modification this effect may be employed in a system for controlling the value of a direct current of constant or slowly varying amplitude in the second circuit by means of a current of the same nature in the first circuit, in contradiction to the large class of devices which are in common use and which accomplish this result only in the case of alternating currents or pulsating direct currents."

From the outset it can be seen that the patentee is providing means for measurements of slightly varying currents, which is not applicable to alternating currents or pulsating direct currents. The circuits are not suitable in connection with the use of photoelectric cells for sound reproduction, as they deliberately show provision for balancing out the effect of the photoelectric cell in the grid circuit by means of a voltage drop in the resistance 13, and the patentee goes on to say that the current in the photo cell may be determined when the voltage drop due to the photoelectric cell and the voltage drop due to the plate current passing through resistance 13, are essentially balanced in the grid circuit.

This produces a minimum of current change in the plate circuit, which can be used to compute the

value of the current flowing in the photo cell. The amount of amplification produced in Figure 1 is very, very small, and entirely insignificant with the amount necessary for sound reproduction, which has been previously stated to be, in the order of millions of millions.

Q. 869. The designation of the Letter A in Figure 1—does that designate a measuring instrument?

A. That designates a direct current measuring instrument.

Q. 870. And are the circuits suitable for photometric uses, to which several of the claims seem to be directed?

A. Yes, sir; they are.

Q. 871. Now, will you refer to the Compton Patent No. 1,567,424, which is mentioned by Mr. Waterman as showing a photoelectric cell, and I ask you to state whether that patent teaches anything with regard to the use of the photoelectric cell for sound reproduction.

A. It does not. It is merely a detail patent of certain desirable features in photo cell construction and gives no indication of any application or usefulness of the photoelectric cell for sound reproduction.

Q. 872. Merely a special construction of a cell itself?

A. Yes.

Q. 873. I refer you to the Kunz Patent No. 1,381,474, referred to by Mr. Waterman as discussing a photoelectric cell, and ask you if that patent discloses anything with regard to the use of the photoelectric cell for sound reproduction or its properties which render it useful for such purposes. And in connection with your answer I direct your attention to the paragraph commencing at line 44 of page 1.

A. This patent merely describes a particular type of photoelectric cell, and methods for its manufacture.

The statement on page 1, line 44, is:

"A cell of this type when properly constructed is characterized by great sensitiveness, uniform sensitiveness over a wide range of light intensities or impressed voltages, not subject to change by aging, rapidity of action, and as I found by experiment, a straight line characteristic curve."

Q. 874. Now, will you please refer, without stopping to read it, to the next paragraph, and state what that has reference to?

A. (Reading): "The human eye is sensitive to light over a range of intensity substantially from one to ten to the twelfth power, but the cell of my invention may be employed for measuring light intensity beyond either limit of the range of the human eye. Thus, for instance, I have found it possible to measure the light given off by a star of the seventh magnitude or the light from a powerful arc."

He is now pointing out the applicability of photo cells for photometric purposes, from the very faint light produced by a star, to the extremely intense light produced by an electric arc.

Q. 875. Is it your opinion or not that his characterization of the cells in the previous paragraphs that what he means there is illustrated by the second paragraph, or did he mean something different?

A. No. He has definitely in mind the measurement of light variation such as we usually call photometry, and states that the cell may be used for measuring not only visible but also invisible light.

Q. 876. And that it has these characteristics for these purposes?

A. Yes, sir.

Q. 877. Now, will you refer briefly to the Hull Patent No. 1,313,187, referred to by one of the defendants' witnesses—I believe it was Dr. Story—as Defendants' Exhibit 41?

A. The Hull patent indicates an application of the so-called dynatron principle, which is exhibited in certain types of vacuum tubes. In Figure 1 he shows a connection of a photoelectric cell connected with the vacuum tube. As Hull points out, under certain laboratory conditions, it is possible to get an amplification of approximately 1000 to 1. This connection has been criticized a number of times. I believe Dr. Story found that the Hull connection was not satisfactory, and had some new circuits designed for him in his elementary consideration of the work. Dr. Ives has criticized the Hull connection in that it only amplifies when the photoelectric cell currents are already large enough to be measured directly on ordinary measuring instruments.

Q. 878. Who is Dr. Ives?

A. Dr. Ives is one of the physicists connected with the Bell System at the present time.

Q. 879. That is, the Bell Laboratories?

A. I think he is in the Bell Laboratories at the present time; somewhere in the Bell System.

Q. 880. Will you briefly refer to the Royce British Patent, referred to by Mr. Waterman, No. 15,333 of 1912, and state as briefly as possible what that patent discloses and whether it teaches anything at all, or deals at all with sound on film recording or reproduction?

A. It has nothing to do with sound on film recording or reproduction and is merely a device located on the shaft of an automobile engine to cut down to some extent the vibration due to the pulses of the individual cylinders as they fire.

Q. 881. Between the engine and the driven shaft, or on what part of the engine, if you remember?

A. As far as I remember, its location is not definitely stated, although it might be used between the engine and the driven shaft.

Q. 882. Much testimony has been given here by Mr. Waterman and others with respect to flyball governors and other types of centrifugal governor acting to control speed, and some testimony has been given by some of the defendants' witnesses to the effect that ball governors serve as flywheels. Will you please state your opinion with regard to the use and function of speed governors.

A. I think we should classify flyball governors into two general classifications. That is, the type of flyball governors which are used to open or close a valve, admitting steam to steam engines, or perhaps control the current supply to an electric motor. And the second class are those which have their action dependent upon a frictional brake and the pressu. of this brake depends upon the force exerted by the rotating flyballs.

There is considerable difference between these two types of governors. The first type should have as little moment of inertia as possible, in order that it may be quick acting, and that slight variations of speed registered directly on the apparatus produce the desired result.

The second type controls the speed only by putting a varying load on the apparatus. If the speed tends to increase, the friction members are pressed together more strongly——

Q. 883. To do what?

A. To slow down the speed of the mechanism.

Q. 884. By the use of what?

A. Friction members.

Q. 885. Brake?

A. Yes.

In neither of these cases can it be said that the governor exerts any appreciable effect due to its flywheel action. It is true undoubtedly that there is some moment of inertia in the revolving flyball gov-

ernor, but it is usually of such small value in comparison with other moments of inertia in the system as to be a negligible quantity as far as speed control is concerned; and if it were not for the variable friction brake, the flyball governor would have little or no effect on the operation of the system.

Q. 887. That is, in the second class, the flyball governor controls the speed, so far as it does, by applying the brake to the rotating part?

A. Yes. That is its action.

There is another distinction between true flywheel effect and flyball governor effect that is somewhat of a scientific one, and that is the more rapid the speed fluctuations the more effective the flywheel will be and the less effective will a flyball governor be.

Q. 888. I refer you to Defendants' Exhibit 45, the Hoxie machine, as shown in Defendants' Exhibit photograph 52, and I refer you to Mr. Hoxie's testimony at Record, pages 623 to 625, wherein he testified in substance that his electric source for driving the motor of that machine varied from fifteen to twenty volts; that no matter what kind of balance wheel he had on the machine he never could keep it running evenly, so they therefore put a governor on the machine and overran the motor slightly in speed and let the governor determine the speed of the drum; that the object of the governors was to regulate the speed; that the governors went up to a certain point and came to a solid rest, meaning the point where they applied the brake to the machine; that the only fluctuations or running out or in of those balls—meaning the ball governors—would only be the pressure against the brake; that the movement of the balls themselves was negligible; that he never saw the balls move, because the brake came against the stop; that it was pretty definite where they stayed because they came to a solid stop and only just varied the pressure.

Will you please state from the construction of that machine as shown in the Exhibit 45 and Mr. Hoxie's testimony as to how it operated, whether the pulley shown at the center of that machine with the gear wheel on the rim, actually functioned with fly-wheel effect in the control of the speed of the machine, such as it was.

A. I call attention to the fact that the pulley, which is attached to the sprocket shaft, is made in two parts. One part which is not cut out in the center carries the gear teeth which drives the speed governor on its edge. This pulley was apparently first a solid sheet of brass of approximately five-sixteenths in thickness, and the central part has been deliberately turned down, and the weight removed, in order to make it just strong enough to carry the gear teeth on its outer periphery. If it were to be used as a flywheel the maximum amount of the mass that could be carried would have been left in place.

I note also fastened on the rim is another sheet ring of relatively thin dimension, which serves as a pulley to accommodate the belt from the driving motor. I have not been able to get accurate dimensions on this pulley, but judging from general observation, its moment of inertia is very small compared with other flywheels in evidence in this case. It is connected to a 32-tooth sprocket, which means that the speed of rotation of the pulley is only of the order of 180 revolutions per minute; and when it is considered that the energy stored in a pulley varies directly as the square of the speed, it can be seen that the total energy stored in this pulley is of very small value, if not totally insignificant.

Q. 889. Without regard to the matter of load on the machine, what would you say as to the order of magnitude of inertia effect of this pulley, driven at the speed it is driven in this machine, as compared to

the moment of inertia of the flywheel of the patent in suit or the defendants' structure?

A. Whereas I have not had the opportunity to make accurate calculations, I risk a guess that it is somewheres around one per cent. or less.

Q. 890. With regard to the next point that you mentioned, to wit, that this flywheel was geared to a governor, did you say?

A. Yes.

Q. 891. Will you please proceed on that line?

A. As has been pointed out in a number of cases, the controlling effect of the flywheel is only evidenced when its speed is allowed to vary. To absorb speed fluctuations in one direction it must have an opportunity to speed up, and vice versa, to slow down. As can be seen by reference to this model a speed governor is provided, so that when the pulley tends to increase in speed, it is prevented from doing so by the action of the speed governor. And thus effectively, even though there should be any inertia effect of the pulley, the pulley is prevented from exerting this inertia effect by the speed governor, and hence any control over the speed of progression of the film.

Q. 892. The testimony is that the governor remained at its maximum outward position—or, the ball of the governor pressing the brake. In that case is the brake constantly on the so-called flywheel?

A. Yes.

Q. 893. I call your attention to defendants' witness Mr. Steiner's testimony, XQ. 202 at page 549 of the record, as follows, referring to this model:

> "XQ. 202. And the flywheel effect, so to speak, of that type of gear would not have very much function contrasted with what your ball governors would have that you had on here originally, would it? The ball governors would

be the controlling effect in the speed? A. Absolutely, in both cases, with this governor, as well as with the other one."

Do you agree or disagree with that testimony?

A. I agree with Mr. Steiner's testimony in that it shows that the inertia effect of the pulley wheel is of little or no moment in the control of the speed, as I understand it.

Q. 894. Testimony has been given here to the extent and quality of amplification work done by the Western Electric Company to the effect that sound was only made successful by their work. I call your attention to transactions of the Society of Motion Picture Engineers, Volume XI, No. 30 of 1927, directing your attention to pages 301 and 310, and ask you to state as briefly as possible what the diagrams and descriptions there show.

A. On page 301, Figure 6 is illustrated, which is labelled "Frequency characteristics of public address amplifiers." I find from an inspection of this curve that the amplification varies, as close as I can compute it, about 100 per cent. between 3,000 cycles and 5,000 cycles. It may not be quite as high as 100 per cent. The scale of the drawing is small. A very considerable value of variation.

Q. 895. You have stated to me that 310 was not pertinent on the subject?

A. I don't think it is.

MR. WARD: I offer that page (301) of the article in evidence and ask that it be marked Plaintiffs' Exhibit 75.

(Page 301 of transactions of Society of Motion Picture Engineers, Volume 11, No. 20 of 1926, received in evidence and marked Plaintiffs' Exhibit 75.)

Q. 896. I showed you a sketch yesterday which is marked Plaintiffs' Exhibit 46 for Identification, and ask you if you have now had an opportunity of examining and checking that sketch and, if so, can you state whether the two diagrammatic sketches shown on that sheet substantially correctly illustrate Figure 1 of the first German patent and the construction of defendants' model allegedly to represent Figure 1 of the German patent.

A. I have examined this sketch and find that they do so represent the German patent and the defendants' interpretation of what is described in the German patent.

MR. WARD: I offer the sketch in evidence as Defendants' Exhibit 46 in evidence.

(Received in evidence and so marked.)

Q. 897. At the demonstration given to the Court and defendants' representatives by the plaintiffs of the two Tri-Ergon machines, defendants' representatives after that demonstration, I understand, seemed to criticize some feature of the machine illustrating Figures 5 and 6 of the patent in suit. Will you please state as briefly as you can what the criticism was and what was done in regard to the matter.

A. As I was able to gather from overhearing their conversation, it appeared that there was some criticism of the way in which a certain pair——

Q. 898. I don't want to interrupt you, but were they given an opportunity of examining the machines?

A. They were. The machine was taken down and they were allowed to examine as much as was possible to be seen. There was some criticism regarding the way in which a certain pair of helical cut gears operated, and the contention was made that due to the angle at which the gear teeth were made there was an undue pressure between the driving gear and the flywheel. Without subscribing in any way to this con-

tention, I immediately had another pair of gears cut, in which the angle was in the opposite direction, thus entirely eliminating any undue pressure that may have possibly been caused by the original set of gears. The gears being otherwise identical with the original pair.

Q. 899. Will you state what they claimed that pressure did.

A. I believe the contention was that the pressure had some undue damping effect on the action of the flywheel.

Q. 900. Was that pressure, if it existed, sufficient to prevent that spring from functioning to drive the flywheel, that is, so that the spring was driving the flywheel during the running of the machine?

A. No, it was not.

Q. 901. Now, will you please proceed where you left off with regard to the statement that you had other gears cut. State what they were and how they operated.

A. These other gears were made identical with the first pair, except that the angle of cut was in the opposite direction, thus eliminating the pressure in the pressure that might have existed between the gear and the flywheel. A demonstration was carried on last night, at which representatives from both sides were present, and the same film records played as were played in the original demonstration given last week. To my mind there was no difference that I could detect between these two demonstrations.

Q. 902. During the demonstration was the flywheel touched at their request, to oscillate the machine, to see if it came back to steady motion?

A. It was.

Q. 903. After the demonstration were they given full opportunity to inspect the machine and was it taken down for them for this purpose?

A. Yes, we disassembled the machine and allowed them to inspect it.

Q. 904. When that machine was taken down, I noted some bluing or blue color put on the inside surface of the flywheel around the shaft boring. Will you please state what that was put there for, and what that indicated.

A. This is a common mechanical practice to indicate where two surfaces come in contact, and is very frequently used in fitting bearings and operations of that character. The bluing was put on the flywheel to determine whether or not there was any substantial bearing between the flywheel and the drive gear.

Q. 905. You mean friction?

A. Any rubbing between the two, which would have been shown by marks on the bluing, and perhaps some of the blue transferred over to the gear. Upon inspection I noted no indication of any contact between the flywheel and the gear.

Q. 906. You examined the machine before it was disassembled: did you find the flywheel was entirely free with respect to the sprocket shaft, to the extent of the stretching of the spring?

A. Yes.

Q. 907. And was the sprocket shaft freely rotatable in its bearing after the flywheel was taken off?

A. It was.

By Mr. Haselton:

Q. 908. Professor Ballard, will you refer to Cawley Patent No. 1,878,577, please, and state what to your mind is indicated at the numeral 1 in Figure 1.

A. Item 1 of Figure 1 shows a 16-tooth sprocket, and as shown in the cross-sectional view in Figure 2, it is substantially cut away. It is not a solid sprocket, so that it would be much lighter in weight than the ordinary 16-tooth sprocket.

Q. 909. And its inertia would be less?

A. Yes, its inertia would be very much less than an ordinary 16-tooth sprocket.

Q. 910. I show you Plaintiffs' Exhibit 73. Is that a fair example of an ordinary 16-tooth sprocket as to weight and dimensions? I don't mean an accurately cut one necessarily.

A. Yes, it is.

Q. 911. What is indicated at 1a in Figures 4 and 5 of this Patent No. 1,878,577?

A. A sprocket. I should say from counting the teeth shown on one-quarter of the circumference, of approximately 32 teeth. The rim of this sprocket is described as being made of some resilient material, such as hard rubber, and covered with adhesive rubber paint.

Q. 912. I show you Plaintiffs' Exhibit 74, a 32-tooth sprocket. Does that give a fair idea of the diameter of a 32-tooth sprocket?

A. Yes, it does. The diameter is approximately two inches or a little less than two inches.

Q. 913. That is one that is designed to run with standard spacing of perforations? Film with standard perforation spacing?

A. Yes. The diameter of any sprocket with any number of teeth may be computed in that a 16-tooth sprocket is a little less than one inch in diameter, and a 32-tooth sprocket would have a diameter slightly less than two inches.

Q. 914. I refer you to the file wrapper of this Cawley Patent No. 1,878,577. You have told me that you found arguments in this file to the effect that these sprockets comprise weighty masses, giving a flywheel effect. What have you to say as to these arguments? I refer you particularly to pages 35 and 36 of the file.

A. These arguments are fallacious in the extreme, and apparently misled the Examiner into allowing claims having no basis in the application as filed. For

instance, it is argued that the pickup button shown at 7 in Figure 1 would have a diameter of 2¾ inches, and that the sprocket would be correspondingly larger. This argument ignored the fact that in the drawing of Cawley's 1919 application, upon which this patent was alleged to have been based, this button was shown to have been about one-half inch in diameter, which is approximately the normal size for such a pickup button. This argument further ignored the fact that Figure 1 shows a 16-tooth sprocket and, since the sprocket was admitted to be used with standard film, the diameter of the sprocket would be slightly less than one inch. At page 35 in the file, Cawley also argued that the dimension of the sprocket might be calculated from the film width shown. His contention is that the distance between the two rows of sprockets is a fixed standard. From this calculation he erroneously estimates that the sprocket shown here weighed four pounds. I might state that his calculations here are ridiculous, because he has not used the right formula for the weight of the sprocket. The calculation showed the area of the periphery rather than the weight of the sprocket, and of course his results which he obtains are totally in error.

Q. 915. I refer you to numerous references to flywheels, weights, and dimensions, found on page 2 of the patent as issued. For instance, lines 17 to 56, lines 72 to 91, and to similar statements found in the claims. Was this subject matter in the original application as it existed prior to the issuance of the patent in suit, and was it in the alleged corresponding 1919 application?

A. No. That subject matter in the specification was added in October or November of 1931, and the first claims and discussion of this subject matter occurred in 1929.

Q. 916. I refer you now to the file of the Cawley Patent No. 1,594,662, which was filed in October, 1919.

There is some brief reference there to a large sprocket wheel. In your opinion what was meant by that?

A. The reference to a large sprocket wheel simply means a sprocket no larger than the 32-tooth sprocket indicated in Figure 7 of his original drawings. He has stated quite specifically as to the size of the sprocket in the original drawings. They simply distinguish between the small 16-tooth sprocket.

Q. 917. Would such a sprocket as disclosed have such inertia as to make it effective in eliminating irregularities in the movement of the film over it, in your opinion?

A. Such a sprocket as disclosed would have a very small moment of inertia, and since it is built with a resilient rim of very much lower weight than the rest of the mass, it has accordingly hardly more flywheel effect than a small 16-tooth sprocket.

Q. 918. I find a brief reference in this file to "absolute uniform speed." Is there any indication in the application as filed as to what he meant by that?

A. No, it is not defined in any very accurate terms. I do find in another of his applications, filed later in 1919, that he states on page 13 of the file wrapper, in reference to a similar construction: "An absolute uniform speed is necessary for sound recording, and for this reason the camera should be driven by some form of motor, pneumatic, gravity, electrical or other." The pneumatic motor is similar to a steam engine. It has pistons and cylinders and is notoriously irregular in speed, indicating that his statement is merely a very broad and general statement.

Q. 919. You were reading from the file wrapper of Patent No. 1,420,304?

A. Yes.

Q. 920. I refer you now to the Cawley Patent No. 1,825,441, application for which was filed in 1921.

Was there any disclosure or suggestion of a photoelectric cell in that application as filed, or at any time in the file prior to the date of the application for the patent in suit?

A. There was no reference whatsoever to a photoelectric cell.

Q. 921. Was there any optical system disclosed in that original application for translating sound to or from a sound record?

A. No. The only thing shown was a crude type of incandescent lamp, shown at the end of a revolving arm. There is no means for limiting the light to anything of a commercial or useful size. I would say that the spot of light would probably be a considerable fraction of an inch in width.

Q. 922. I refer you to page 12, at the bottom of the page of the file. Is that an operative arrangement for a slit there described?

A. In order to cut down the length of the testimony as much as possible, I will not read the reference I will say that it is a completely inoperative arrangement indicated at the bottom of page 12 of this file wrapper.

Q. 923. In your opinion, was the scheme which he disclosed in this application as a whole operative?

A. It was not.

Q. 924. In what respect was it inoperative, taking up first the slit matter?

A. The slit shown with the selenium cell was in the wrong direction. Instead of being transverse to the motion of the film, it was at right angles to this position, or in the same axis as the motion of the film. And this, of course, would have had no possible action in limiting the area of illumination to a small portion and thus enabling sound reproduction to be obtained.

Q. 925. Was there any fixed translation point in his arrangement?

A. No, there was no fixed translation point in his arrangement. The translation point was on the end of a revolving arm.

Q. 926. In the application as filed, did he disclose or suggest the use of a flywheel or other weighty mass in connection with a moving film?

A. There is no hint of a flywheel or other weighty mass in connection with the moving film.

Q. 927. If there had been a massive wheel described there, would it have been effectual in eliminating irregularities in the film movement in respect to the light beam?

A. No. It would not, because the primary requisite is to have the film pass the translation point at a uniform speed, and if the translation point is moving at a variable speed, as it would be in the Cawley disclosure, it does not make any difference whether the film is moving at a uniform speed or not.

Q. 928. If he had used his proposed revolving stylus, instead of a light beam, would it have been inoperative?

A. In my estimation the reproduction would have sounded a good deal like a machine gun. Each time the stylus contacted with the film or left the film, there would have been a loud click, which, occurring at very rapid intervals, would have completely overpowered any sound reproduction.

Q. 929. What would have been the effect of the commutator which he showed in connection with the electrical system?

A. The commutator is intended to put the reproducing light out and on at periodic parts of its travel.

Q. 930. I refer you to Cawley Patents Nos. 1,825,438, 1,825,439, 1,825,440 and 1,825,441. Would the answers which you have given with respect to his 1921 application apply to those patents, in so far as they

may have been based upon any disclosures in the original application?

A. Yes, they do.

Q. 931. Are those patents understandable?

A. I have been unable to understand many of the features described in those patents.

Q. 932. I refer you now to the Pfannenstiehl Patent No. 1,728,304—and particularly to the statement beginning at line 97, page 1, of the specification. Does that statement support the testimony, or is it consistent with the testimony that you have heard here by the defendants' expert on the matter of flywheels associated with undamped springs?

A. It does not correspond to the testimony that I have heard in this particular connection. That is, the statement which you referred to in the patent, refers to a flywheel which is driven by springs. One end of the spring being connected with the flywheel and the other end to an arm on the driving shaft. The construction in that respect being very much as shown in the patent in suit. Pfannenstiehl first distinctly teaches that such springs with the flywheel in and of themselves act as damping means. That is, from a reading of this patent it is evident that he teaches that the spring and flywheel, without any special damping means, may act as damping devices, and he teaches that this arrangement without any special damping, is of distinct benefit in preventing variation in the movement of the film. Pfannenstiehl also finds that it is helpful under certain conditions to provide an additional spring, which is wound around the top of the first spring mentioned, but does not state that this is an essential part of the invention in any respect.

MR. HASELTON: I offer in evidence file wrapper of the Pfannenstiehl Patent No. 1,728,304, and ask that it be marked Plaintiffs' Exhibit 76.

(Received and marked Plaintiffs' Exhibit 76.)

JOSEF ENGL, recalled as a witness in behalf of the plaintiffs, in rebuttal, having been previously duly sworn, further testified as follows:

DIRECT EXAMINATION.

By MR. WARD:

Q. 938. Dr. Engl, certain helical gearing in the Tri-Ergon machines were criticized by the defendants' representatives. I will ask you if the same gearing as used in the machine demonstrated was used in any of the German machines which you built.

A. Yes, just exactly the same gears that we used in the demonstration in court were used over in Germany in the year 1922, 1924, 1925, and in the following years. We never changed the construction of those gears.

Q. 939. I refer you to your notebook——

THE COURT: Is that the same notebook that we went over before?

MR. WARD: We are putting these sheets in evidence.

MR. ASHTON: Why don't they offer the whole book?

THE COURT: Isn't this rebuttal? Rebuttal should not be going over the whole case and putting it in again.

MR. WARD: This is just answering what they brought out in respect to this stipulation.

Q. 940. I refer you to this sheet of your notebook and ask you to state what date that was.

A. The date was between May 11th, 1921, and May 20th, 1921.

MR. WARD: I offer the sheet that the witness refers to as Plaintiffs' Exhibit 77, and ask that a photograph may be substituted for the original.

(Sheet from Engl notebook between May 11 and May 20, 1921, received in evidence and marked Plaintiffs' Exhibit 77.)

MR. WARD: I offer in evidence photographic strip bearing the Vogt initial, and the date of May 5th, 1921, found in the notebook adjacent the sheet marked with the Vogt initials and dated May 11th 1921, and ask that the same be marked as Plaintiffs' Exhibit 78.

(Received in evidence and marked Plaintiffs' Exhibit 78.)

Q. 941. I refer you to another page of the notebook that you testified about with regard to gear arrangements, and ask you what the date of that is?

A. The date of that is February 10th, 1921.

MR. WARD: I ask that this be marked in evidence as Plaintiffs' Exhibit 79 and that photographs of the same be substituted for the original.

(Sheet from patentees' notebook dated February 10, 1921, received in evidence and marked Plaintiffs' Exhibit 79.)

Q. 942. I show you another page and ask you what the date of that page is?

A. That date is the same.

MR. WARD: I ask that that page be marked as Plaintiffs' Exhibit 80 and that photographs be substituted for the original.

(Additional sheet from patentees' notebook dated February 10, 1921, received in evidence and marked Plaintiffs' Exhibit 80.)

Q. 943. I show you a page showing some curves and figures, and ask you what that is?

A. This page shows the relationship between glow discharge current and density. The date of this page is January 26th, 1921.

Q. 944. Curves made by whom?

A. The curves are made by myself.

MR. WARD: I ask that the sheet referred to by the witness be marked in evidence as Plaintiffs' Exhibit 81 and that photographs be substituted for the original.

(Sheet from patentees' notebook showing relationship between glow discharge current and density, dated January 26, 1921, received in evidence and marked Plaintiffs' Exhibit 81.)

Q. 945. I show you another sheet with some figures and curves, and ask you what that is.

A. This sheet shows the linear relationship between photoelectric currents and slit opening. The date of the sheet is January 26, 1921.

Q. 946. Who is that signed by?

A. Signed by myself.

MR. WARD: I ask that this sheet be marked as Plaintiffs' Exhibit 82, and that photographs be substituted for the original.

MR. ASHTON: I am reserving objection as to all of these pages for the moment.

THE COURT: What is your objection?

MR. ASHTON: My objection is that I insist that the whole notebook go in, if they put these pages in.

MR. WARD: We did not ask for the Hoxie notebooks that they put in, and these notebooks are important——

THE COURT: It is a general principle that you should not pick out a part of the whole book to suit yourself.

MR. WARD: They have examined the book.

MR. ASHTON: This is on the question of the lack of joint inventorship. This notebook, as shown from an actual count of the pages, is largely in the handwriting of one of the patentees.

THE COURT: I will let them put it in. If they go into it I may let you put the whole book in.

(Page dated January 26, 1921, from patentee's notebook, received in evidence and marked Plaintiffs' Exhibit 82.)

Q. 947. I show you another sheet and ask you what that is.

A. This sheet is a comparison between different optical arrangements, showing optical slits, for instance, in the second and third picture. And it is dated September 23d, 1920.

Q. 948. And witnessed by whom?

A. Witnessed by Vogt.

MR. WARD: I offer this sheet in evidence as Plaintiffs' Exhibit 83 and ask that photographs be substituted for the original.

(Sheet from patentee's notebook dated September 23, 1920, received in evidence and marked Plaintiffs' Exhibit 83.)

THE COURT: Wouldn't this examination have been proper in chief?

MR. ASHTON: Yes.

MR. ASHTON: Yes. I ask if the plaintiffs are going to put in the whole notebook.

MR. WARD: Your Honor, Dr. Engl said that he would like to keep his notebook.

MR. ASHTON: He can put in photostats of it and a translation of the notebook.

MR. WARD: Will you put in all of Dr. Story's notebook and all of the other gentlemen's notebooks?

MR. ASHTON: I certainly will. I will be very glad to, if you want them.

THE COURT: I do not think anything ought to be concealed on either side. If there is anything else in this notebook that is applicable to this case I will let you put it in. I am trying this case and I cannot help it if it reveals any trade secrets or anything else. I have no feelings on that subject at all except to get the evidence in in this particular case. I just want you to understand that, on both sides.

MR. WARD: We may have a copy of Mr. Story's notebook too?

THE COURT: I am not interested in anything else at the moment, but I am interested in anything in the notebooks that will be helpful in this case.

MR. ASHTON: I agree to produce Dr. Story's notebooks for the further examination of the plaintiffs in the presence of a representative of the defendant, if it is requested by the plaintiffs. I know, however, of no such request having previously been made until the plaintiff was faced with the necessity of putting in evidence the complete Engl notebook.

I now offer in evidence the remaining pages of the Engl notebook and translation thereof, which I request to be produced by the plaintiff and ask that copies be substituted for the original pages of the notebook.

THE COURT: I think I am inclined to receive it; unless there is any reason to the contrary.

MR. WARD: I am not objecting if they want it in.

MR. ASHTON: I suggest that the notebook, as a whole, receive the next defendants' exhibit number.

(Notebook identified by Engl received in evidence and marked Defendants' Exhibit 156.)

CROSS-EXAMINATION.

By MR. ASHTON:

XQ. 949. Is this a correct statement, that in the notebook, Defendants' Exhibit 156, to which you have referred, that there are approximately fifty-three sheets of data, and about fourteen sheets of correspondence; that of these fifty-three sheets, thirty have the letters "GT" thereon, which indicates that the data on these pages were entered by Hans Vogt, one of the patentees of the patent in suit; at least twelve of the remaining sheets not having these letters thereon are in the handwriting of Hans Vogt; that the sheet referred to by you at record, pages 223 *et seq.* as showing two arrangements for supporting and driving the film, and the sheet referred to at 227 *et seq.* as showing tests to check the speed of the film, are each in the handwriting of Hans Vogt.

A. No, I don't think that statement is correct.

XQ. 950. Please state in what connection it is not.

A. I tried to count the sheets myself several times, and I could not find the thirty pages you refer to.

XQ. 951. How many did you find?

A. I found about twenty-five, including those letters.

XQ. 952. Are there any sheets in here in Mr. Massolle's handwriting?

A. Signed by Mr. Massolle, or in his handwriting?

XQ. 953. Anything in his handwriting or signed by him.

A. Yes.

XQ. 954. How many?

A. I cannot tell you now.

XQ. 955. Will you point to three places in the notebook, one showing your handwriting, one showing the handwriting of Mr. Vogt, and one showing Mr. Massolle's handwriting, and identify the pages by marking them with a letter up in the right-hand corner, A, B and C, respectively. Starting in the order of Engl, Vogt and Massolle. Mark it with an A for yourself, a B for Mr. Vogt, and C for Massolle.

XQ. 956. You can use E for yourself, V for Vogt, and M for Massolle.

A. I mark here pages 81 and 82 with an E, and I mark page 80 with a V. I doubt whether I can find any special page in the handwriting of Mr. Massolle. But I find his signature.

XQ. 957. Do you find his signature?

A. Yes. Here, for instance.

XQ. 958. And will you mark that with an M?

A. I did.

XQ. 959. Whose handwriting is on the rest of the page?

A. It is partially mine and partially Vogt's.

XQ. 960. Whose notebook was this?

A. That is one of our common notebooks——

XQ. 961. Who had charge of this notebook?

A. All three.

XQ. 962. Three of you kept one notebook?

A. No, not one; about twenty.

XQ. 963. Who kept this particular notebook?

A. What do you mean by "keeping"?

XQ. 964. Who had charge of it? Who kept it in the desk?

A. We used it all three exactly in equal terms.

XQ. 965. Where was it kept?

A. In the desk.

XQ. 966. Whose desk?

A. A drawer of a desk.

XQ. 967. Whose desk?

A. Our desk. We could not allow three desks for three inventors.

XQ. 968. Three people at one desk?

A. Yes; exactly.

XQ. 969. And what else did you have in common?

A. What we had in common?

XQ. 970. Yes.

A. A whole laboratory.

XQ. 971. You did not mean to say, Dr. Engl, that the gears that are on this machine which you demonstrated in the first of plaintiffs' demonstrations were made in 1922, did you?

A. No.

XQ. 972. When were they made?

A. 1924 and 1925.

XQ. 973. You testified earlier in the examination, as I remember, that this machine was made somewhere around 1926 or 1927, didn't you?

A. I think you remember wrongly.

XQ. 974. When was it made?

A. Construction has been completed, as I testified, in the year 1924, and during the course of the year 1925 the lot of twenty-five has been built, and this machine is one of this lot.

XQ. 975. When was the grease cup put on it?

A. When was the grease cup put on it?

XQ. 976. Yes.

A. I could not tell you exactly.

XQ. 977. Was that recent?

A. Certainly before it has been brought over here.

XQ. 978. When was it brought over?

A. 1926. The end of the year 1926.

XQ. 979. Are you very certain of that?

A. Yes, sir; I am absolutely certain of that.

XQ. 980. When was the spring put on it?

A. Which spring?

XQ. 981. The spring that you demonstrated the first night.

A. I could not tell you. Probably some weeks or months before that, because the machine had been stored and had to be overhauled anyway.

XQ. 982. The very same spring was used in 1926?

A. Certainly not.

XQ. 983. When was this spring put on it?

A. I cannot tell you anything about it, because I did not bring the machine to operation.

XQ. 984. Who put it in operation? Who had charge of it?

A. As far as I know, Professor Ballard.

XQ. 985. Did Mr. Ward have anything to do with it?

A. Probably, yes.

XQ. 986. Who made the new gears?

A. I don't know.

MR. WARD: Are you talking about the ones made this week?

MR. ASHTON: I said the new ones.

MR. WARD: We can tell you that, if you want to know it.

MR. ASHTON: All right. You tell me.

MR. WARD: Mr. Joy sent one of his mechanics down to New York the day after the performance was given to your Honor, with instructions to have gears cut with the reverse cut on the gears, and they were cut in New York City and returned here about two days ago.

WILLIAM C. BALLARD, resumed the stand.

CROSS-EXAMINATION.

By MR. ASHTON:

XQ. 933. Now, Professor Ballard, you stated in your direct examination, didn't you, that you had had considerable music experience?

A. Yes.

XQ. 934. And you stated that you started in when you used to live in Baltimore before you entered college?

A. Yes.

XQ. 935. And that you were chief musician of the university band?

A. Yes, sir.

XQ. 936. And taught harmony in the university?

A. Yes.

XQ. 937. In 1919 and 1920?

A. Yes.

XQ. 938. What is your work in the university?

A. Professor of electrical engineering and head of the department of communication engineering.

XQ. 939. Who is the head of engineering at Cornell: engineering, electrical engineering?

A. P. M. Lincoln.

XQ. 940. You are one of the professors under Professor Lincoln?

A. I head the department of communication engineering. He is director of the school.

XQ. 941. Do you have to do with music in that department?

A. No. Other than the recording and reproduction of music in connection with broadcasting and things of that sort: to that extent.

XQ. 942. I believe you testified that in the defendants' demonstrations, that apart from the constant frequency notes there was no opportunity to

judge whether speed variations were present or not, because of the character of the pieces used: is that correct?

A. I don't think I so testified. I criticized the character of the compositions which were given, as being those less likely to indicate such speed variations.

XQ. 943. Do you say now that you could tell that from defendants' musical pieces?

A. I heard in one or two places a slight fluctuation where the tones were sustained.

XQ. 944. Do you remember any of the pieces?

A. I did not know the name of the waltz or the march that were played.

XQ. 945. Do you remember the names of any of the pieces that were played? Did you recognize any of them?

A. Yes.

XQ. 946. Which one?

A. The Liszt Second Hungarian Rhapsody.

XQ. 947. Any others?

A. For the moment I don't know what the other compositions were. They were very trivial compositions.

XQ. 948. I beg your pardon?

A. They were very trivial compositions, as far as I know.

XQ. 949. So you don't remember any of the others that were played?

A. No.

XQ. 950. Did you hear the Watson record and also the Minstrel record played?

A. Yes.

XQ. 951. Do you remember that "Silver Threads Among the Gold" was played during the Kinetophone Minstrel record?

A. I don't remember for the moment whether that was played. I would, of course, have recognized it had it been recognizable. My impression was——

XQ. 952. You don't remember that it was played?

A. No.

XQ. 953. Will you tell me whether there are any sustained notes in Silver Threads Among the Gold?

A. Yes, there are some sustained notes. Of course, it depends on how rapidly you sing it.

XQ. 954. How was it played the other night? Was it played fast or slow?

A. It was played at a pretty good tempo, yes.

XQ. 955. You know perfectly well, don't you, that that was played quite slowly the other night, Professor Ballard?

A. I would not say that it was unduly slow.

XQ. 956. You don't want to change your opinion on that?

A. No. I have not expressed any opinion to that effect.

XQ. 957. Are there any sixteenth notes in this? Isn't the fastest note an eighth note?

A. Yes; that is entirely immaterial, because with some compositions a sixteenth note occupies a good deal more time than an eighth note in others.

XQ. 958. Are there any full notes in this? Do you see any in that piece?

A. I don't know what you mean by full notes. The term does not mean anything to me musically.

XQ. 959. Will you point out these notes that are marked: what they show?

A. I see a dotted quarter marked as one and a half. I don't know what that means. And I see a half note here marked as 2. That probably has some significance, but I don't know what it is.

XQ. 960. The fact is that there are plenty of sustained notes?

A. I would not say that they were sustained to the extent where speed fluctuations could be determined.

XQ. 961. What is the tempo of the piece?

A. As marked here?

XQ. 962. Yes.

A. It is marked "andante."

XQ. 963. What does that mean?

A. It means moving along; it comes from the Italian word meaning to walk.

XQ. 964. Doesn't it mean slow?

A. Not necessarily.

XQ. 965. Doesn't it mean, in common parlance, slow?

A. No.

XQ. 966. What does it mean?

A. It means moving along.

XQ. 967. Rapidly?

A. Moving along at a fair rate of speed, such as you would walk along. That is the significance of the term.

XQ. 968. You referred to the test on the Kinetophone. Was the variation which you referred to in your direct testimony, a cyclic variation such as might be due to the flywheel being somewhat out of balance?

A. I only heard it during one brief sustained tone, and therefore I could not judge whether it was a cyclic variation or what other type. There was a distinct variation in one or two cases that I noted.

XQ. 969. Will you point in this Kinetophone machine to the element which I believe you have testified would introduce speed variations?

A. There are a number of sources of speed variations here, and the effect is cumulative.

XQ. 970. Talk about the feed screw first.

A. The feed screw is connected with a series of spur gears to the driving shaft. Spur gears are no-

torious in that they do introduce irregularities. There are three cut spur gears. Not cut helically, as in the demonstrated machines.

XQ. 971. Where is the element that rests on the feed screw?

A. I am putting my finger on it now.

XQ. 972. And it is your testimony, is it, that that half nut or less than half nut arrangement would introduce speed variations of a sufficient order to distinguish the motion of the mandrel from the patent in suit?

A. I did not so testify.

XQ. 973. What is your testimony?

A. I testified that somewhere in the machine there was an accumulation of speed irregularities which could be detected. This is probably one of the contributing factors.

XQ. 974. Are you sure whether it is or not?

A. Yes. Probably one of the contributing factors.

XQ. 975. Will you step aside and point out on the machine why?

A. There is the feed screw driven with a set of gears. The eccentricity of these gears I am not able to determine——

XQ. 976. I said to confine yourself to the screw on the mandrel shaft.

A. I am talking now about what drives the screw. The source of the irregularities, I understood you to ask for.

XQ. 977. I ask you to confine your answer to the small half or quarter screw arrangement on the screw feed shaft.

A. The friction at the nut which must be applied through the driving gears is an irregular one.

XQ. 978. You have testified, but have you tested it to see that that is so?

A. I had no opportunity to test this machine. I have seen other machines of the same type.

XQ. 979. And you have tested other machines to know that there would be sufficient difference in speed uniformity due to that nut engaging the feed screw, so that you would find in it a distinction from the patent in suit?

A. Mr. Ashton, you are trying to make me say things that I have not said.

XQ. 980. Then please state what you said?

A. I say that the accumulation of irregularities was sufficient——

XQ. 981. I have asked you to confine yourself to the feed screw.

A. Yes.

XQ. 982. Confine yourself to it then. Is there enough in the feed screw to make a distinction, as you put it?

A. When combined with other irregularities, there was in this case, yes.

XQ. 983. You will not answer my question. I am asking you to confine yourself to the feed screw and tell me whether or not that alone is sufficient to make the distinction which you seek to make.

A. I have no means of answering that question, because I have not tested this. I don't know in what proportion the irregularities were produced by the various contributing elements.

XQ. 984. Have you any quantitative data at all on such feed screw operations?

A. I have never seen a machine of that sort before this one was demonstrated. I never made a test.

XQ. 985. But you had no hesitancy in testifying that it would introduce fluctuations?

A. I have seen similar mechanism.

XQ. 986. You have done an awful lot of work on those?

A. Not an awful lot.

XQ. 987. Would you pit yourself against an expert who has worked with phonographs, as to whether or not these feed screws would introduce fluctuations of the order which you have testified to in your direct testimony?

A. I think you are wasting time, Mr. Ashton. I have not testified that the fluctuation was due entirely to the feed screw. I have said it was a combination of various elements in the machine, and I have no means of saying whether 10 per cent. was due to the feed screw and 90 per cent. to something else, or vice versa.

XQ. 988. You haven't any means of saying whether any percentage was due to anything?

A. I have no way of testifying where the proportion is.

XQ. 989. And your testimony is due to what you think instead of what you tried?

A. I know there were irregularities, and I know what was there to produce it.

XQ. 990. What irregularities did you find in this machine?

A. This is driven by a spring motor controlled by a friction type governor, which has long been recognized as a source of irregularities. There is possible slippage of the belt, irregular load of the mechanical stylus, and many other contributing factors.

XQ. 991. You testified that the PS1 machine of the defendants here had some speed variations in it. Would you or would you not say that those variations were of the same order as in the Kinetophone and in the Weber-Edison machine?

A. To my mind they were of a very less order of magnitude than in the Weber and in the Triumph rebuilt model.

XQ. 992. And you base that on the records of the defendants?

A. And based on the demonstration that I heard the other evening.

XQ. 993. You testified, didn't you, that the Edison records were off center?

A. I don't think that I definitely testified that they were off center. I rather suspect that they are. I have made no measurements to that extent.

XQ. 994. In your direct examination you testified that the so-called Edison Triumph machine was not played with a music record, and then yesterday I believe you expressed some doubt on that. Have you examined the program which was given at the defendants' demonstration to see whether it indicated that anything else was to be played? Look at Item 18-A.

A. I note on the program that "Speech, etc.," is marked down. The notes that I made at the time did not indicate whether more than one speech was played, and I was somewhat indistinct as to whether anything else besides speech had been played.

XQ. 995. And you did not remember whether anything but speech had been played?

A. My notes did not so indicate. My memory may have been refreshed by hearing—by seeing other people's notes on the subject, but I don't remember now.

XQ. 996. What would you say about that record with the waltz on it, as you now remember it?

A. Which record and which waltz?

XQ. 997. I withdraw the question. What records were played, if you now remember it, on the little, small cylindrical record, the very small one?

A. I cannot answer that question without referring to my notes.

XQ. 998. Get your notes.

A. My notes do not go into the fact whether there was anything other than speech that was played. This is a copy of the original note that I made.

XQ. 999. Have you any recollection now as to how the machine was demonstrated?

A. I have notes referring to the fact that it was not possible to indicate speed fluctuations with defendants' record that was played.

XQ. 1000. Not possible to do what?

A. That the record that was played would not indicate speed fluctuations.

XQ. 1001. That is the waltz record?

A. I am referring now to 18A?

XQ. 1002. Yes.

A. If a waltz were played, that would be true.

XQ. 1003. And you don't remember whether a waltz was played or not?

A. No. It was a very short record.

XQ. 1004. You have testified that you heard PS16 machines which were better than the one which they demonstrated. Where did you hear those?

A. Well, I have heard a good many RCA reproductions in various places around the country. I don't remember exactly now where those machines are located. There is one in Ithaca, which I think is a PS16 machine.

XQ. 1005. You have examined them in the theaters, haven't you?

A. No, I have not seen them in the theaters; but the general quality of the RCA reproduction was better than that given in the PS16 on the demonstration, to some extent.

XQ. 1006. You did not mean to testify then that you had seen some particular PS16 machine that you were talking of?

A. No.

XQ. 1007. Your testimony reads that way, however, does it not? You said on page 736:

> "I have heard other PS16 machines give very much better reproduction."

A. Yes

XQ. 1008. Wait a minute. "I am somewhat at a loss to know why Test 23 was not better than it was."

Do you wish to change that testimony now?

A. No.

XQ. 1009. Then how do you know that you heard some other PS16 machine?

A. Because I have been at many reproductions where RCA apparatus was used, and I assumed that a PS16 machine was at least used in some of them.

XQ. 1010. You are assuming it, are you?

A. Yes.

XQ. 1011. Then you do wish to change your testimony, don't you?

A. No.

XQ. 1012. I believe you testified that the PS16 machine was better, in your opinion, than the model of the early German patent. Do you wish to state now that that is your belief?

A. As already stated, I have devoted hours and hours in listening to records which were reproduced on various types of machines in connection with the work that I did with Mr. Case, and therefore I feel that perhaps my ear is a bit more sensitive than the average listener's. The variation between these two machines would probably be one or two per cent. rather than 50 or 60, or any large amount. Both machines were very good from a commercial standpoint.

XQ. 1013. Both the old German and the PS16 were very good?

A. Yes, I think so.

XQ. 1014. If I told you that a group of experts were of a contrary opinion, would you be likely to change your testimony?

A. Not in the slightest.

XQ. 1015. Would you say that the flutter in both the PS16 and the early German machine based upon Tests 25 and 26 were of the same order?

A. I don't know what you mean in that question by "of the same order." The same order of magnitude, or the same order of frequency, or what?

XQ. 1016. Define it as you will.

A. There was not a great deal of difference in these two cases, as I remember it.

XQ. 1017. Then it is fair to say that they are of the same order?

A. Well, it depends on what you define by "order."

XQ. 1018. No very wide difference between them?

A. No, I would not say there was any wide difference.

XQ. 1019. At page 737 of your testimony you testified that the Tests 27 and 28, which were the demonstrations of the PS1, damped and undamped, enabled you to determine that when the machine was undamped that the reproduction was uncommercial, and could be detected during the waltz selection.

A. Yes.

XQ. 1020. The waltz was useful for that purpose, wasn't it?

A. On very wide speed fluctuations, a waltz could be used, of course, but it was not useful for fine low intensity speed fluctuations.

XQ. 1021. I believe you testified that the drive which was made of the Amet patent was uncommercial, did you not?

A. (No answer.)

XQ. 1022. The drive which was demonstrated by the defendants?

A. You mean the test in which the defendants demonstrated their alleged embodiment of the Amet patent?

XQ. 1023. Yes.

A. There was quite a considerable fluctuation that might have been acceptable in a small town house where the audiences are not very particular. I don't think it would have gone in New York City very long.

XQ. 1024. It worked better than the undamped spring of Figure 5 of the patent in suit, didn't it?

A. Oh, I think so, yes.

XQ. 1025. You did not mean to say that it was not operative, did you?

A. It would not be operative in New York City——

If now you are referring to the test in which the device which was alleged to have been built according to the Amet patent and with which I cannot of course concur, because it departs in all of the essential respects from the description of the Amet patent—I should say that the results were such that on speech perhaps and certain types of music the audience would not get up and walk out. With other types of music they probably would.

XQ. 1026. You did not mean to say, did you, that the model of the Constable drive, demonstrated in defendants' exhibit machine was inoperative, did you?

A. Inoperative for what purpose? For high quality reproduction?

XQ. 1027. Inoperative in the patent sense.

A. Not being a patent expert, I cannot answer that question.

XQ. 1028. Answering it as to the commercial sense.

A. I don't think that a machine built with this special type of spring drive could stay sold very long. I think the audience would object to it, because there were very distinct wows and speed fluctuations very noticeable in certain types of reproduction.

XQ. 1029. You really thought it was pretty good, didn't you?

A. I certainly did not.

XQ. 1030. Will you look at the Dragoumis patent, Item 46 in our book, and point out on the drawing of Figures 1 and 2 the feed screw and the revolution counter which you said introduced speed fluctuations.

A. I don't think I used the word "revolution counter," did I?

XQ. 1031. What is it? What is the element 14?

A. The element 14 is an indicator.

XQ. 1032. What does it do?

A. It shows the position of the stylus as it moves along parallel to the axis of the cylinder.

XQ. 1033. Tell me whether or not these feed screws are geared down.

A. According to the patent they are geared, yes.

XQ. 1034. They are geared down?

A. I don't think that the patent is very clear on that point, because it depends upon the fineness of the thread cut upon the carriage screw.

XQ. 1035. What is your best opinion?

A. It looks as if they might possibly be geared down.

XQ. 1036. Aren't they always?

A. I have never seen an apparatus built acording to the Dragoumis patent before.

XQ. 1037. Have you ever seen any phonograph in which they are not geared down?

A. I think there is not much gear reduction in the machine here.

XQ. 1038. Is this geared down at all?

A. It is geared down in the ratio of approximately two to one.

XQ. 1039. Isn't that the usual arrangement?

A. I would not say that it is at all universal. It is common practice, I believe with the Edison people.

XQ. 1040. Isn't it perfectly clear from the Dragoumis patent that it is two to one?

A. It certainly is not. There is no indication whatsoever that it is two to one. In fact——

XQ. 1041. Just tell me how this device 14 that you have referred to as an indicator would introduce speed fluctuations.

A. May I add something to the previous answer before we go on to this?

XQ. 1042. Yes.

A. I am reading now from my translation of the patent, the last paragraph before the claims:

> "The gearing which transmits the movement of the drum to the carriage screw should be changeable by known means. Thus there should be two or three different ratios of turned reduction corresponding to different lengths of the band, with the bands of a large number of different lengths, the gear box described in the French Patent No. 256,046 of April 16th, 1912, should be used."

I think this aptly answers your question that the ratio of the gear is purposely made variable to take care of individual conditions.

XQ. 1043. Then if it were cut lower there would be less of these variations that you say are introduced, would there not?

A. I don't think that follows, no.

XQ. 1044. What would follow?

A. It would depend entirely upon the accuracy with which the gears were cut, and the friction of the lead screw.

XQ. 1045. Assuming they were the same, before you changed them.

A. I don't understand how they can be the same if they are changed.

XQ. 1046. I said, the feed screw is the same?

A. The feed screw, if operated at a lower speed, would have to have a coarser thread, and a correspondingly heavier load in moving the carriage.

XQ. 1047. Then it would be more variation?

A. I don't think it makes much difference with regard to the gear reduction, because you use a different lead screw when you change the gear ratios.

MR. ASHTON: Now will you repeat my previous question.

XQ. 1048. (XQ. 1041 repeated.)

A. This device is driven through a series of spur gears from the main shaft, and any inaccuracy of the spur gearing would of course produce irregularities of load upon the cylinder carrying the record.

XQ. 1049. You think that would be very substantial, do you?

A. Since this machine was never built——

XQ. 1050. How do you know that?

A. To my knowledge.

XQ. 1051. You never heard of it being built, did you?

A. Never heard of it being built. I obviously cannot risk a guess on something being friction free that I have never seen even demonstrated.

XQ. 1052. But you are guessing that there was friction in it?

A. I know that there is always friction in any kind of mechanical movement. I have never seen any perpetual motion machines yet.

XQ. 1053. You testified, didn't you, that you thought the reproduction of the Hoxie March 8th, 1921 film was pretty bad?

A. From present day standards, it certainly would be so considered.

XQ. 1054. Did you understand every word in it?

A. I think I understood every word in it, although it did not seem to be the same voice as Mr. Hoxie used on the stand.

XQ. 1055. I was coming to that next, Professor Ballard.

A. If it was intended to be Mr. Hoxie.

XQ. 1056. You did not recognize anything in that record that sounded like Mr. Hoxie's voice?

A. It sounded quite different to me from Mr. Hoxie. Indeed, I asked you a moment ago if it was Mr. Hoxie, because it did not check up with Mr. Hoxie's voice as I heard him on the stand. As would be supposed from that construction, the high frequency components of the speech which give the timbre or personal characteristics were largely missing.

XQ. 1057. Did you notice any particular characteristic of Mr. Hoxie's speech when he was testifying here for two or three hours one day?

A. That is a hard question to answer.

XQ. 1058. You don't remember, do you?

A. For the moment I do not remember any peculiar characteristic of his speech.

XQ. 1059. If you don't remember him when he was here on the stand testifying, how do you remember so much about the Hoxie record?

A. I said I did not remember any peculiar characteristics of his speech.

XQ. 1060. None at all?

A. Peculiar characteristics.

XQ. 1061. Did he sound like a fairly young man or a fairly old man?

A. While he was on the stand?

XQ. 1062. Yes.

A. He sounded like a man of the age that he gave, I should judge.

XQ. 1063. Do you remember what that was?

A. I think he said he was sixty-six or something like that.

XQ. 1064. He is a little older than that?

A. Is he? I had forgotten.

XQ. 1065. You did not recognize the quality or timbre in his voice when the record was being played?

A. The reproduction undoubtedly had very few of the high frequency components present, and his voice was reproduced in a lower pitch than he probably used in recording it.

XQ. 1066. You testified in regard to the Victrola that Defendants' No. 48 was a reproduction from a modern Victrola. You did not mean to suggest there by "modern" that it was a Victrola more recent than March 24th, 1921, or 1920, did you?

A. No. What I meant to say was that it was an old Victrola modernized and brought up to date; that it had electrical pickup on it which was not originally on the machine.

XQ. 1067. But you had no reference to the drive or the turntable?

A. I don't know of course when that Victrola was built.

XQ. 1068. You characterized it here as "modern." I said is that what you meant, or do you withdraw it?

A. I had of course a definite idea in mind in that statement, that the reproduction was done by a very modern type of electrical pickup, which exerted little or no friction on the disc, and such speed fluctuations as might have been introduced when reproduced by the stylus, were obviously absent.

MR. WARD: We are willing to stipulate the date of manufacture of the machine, to save time.

XQ. 1069. You have heard plenty of Victrolas like that, haven't you?

A. Yes.

XQ. 1070. And are you prepared to testify that there are substantial variations in speed due to the reproducer that is used on those machines when it is of the mechanical type?

A. I have noticed that in many cases, yes.

XQ. 1071. And you are very sure of that, are you?

A. Absolutely.

XQ. 1072. Did you make any critical examination of the electrical pickup which was used on that Victrola?

A. None other than that it, as far as I could determine, was one of the oil damp pickups, put out by the Western Electric Company, of the counterbalance type.

XQ. 1073. Do you feel that you are competent to testify as to the acoustic type of pickup that has been used for years on Victrolas?

A. I don't know what that question means.

XQ. 1074. Prior to 1920.

A. I have seen many of them, yes.

XQ. 1075. You have been talking about them here in this case, haven't you?

A. Yes.

XQ. 1076. As to the speed variations that they would introduce?

A. Yes.

XQ. 1077. Will you tell me the difference between the unbalanced weight of this electrical pickup which was used in demonstrating the Victrola, and one of these pickups known as mechanical pickups?

A. It is pretty hard to give any effective answer in that respect until you exhibit the mechanical pickup.

XQ. 1078. You don't know, do you?

A. Some mechanical pickups have more pressure than this.

XQ. 1079. Take some definite one. Some one that you can think of. I will send over for the Victrola if you want me to.

A. What is it you want me to do?

XQ. 1080. Tell the difference between some particular pickup and this one.

A. I have seen pickups that had more pressure than this, yes.

XQ. 1081. Does the ordinary one that was used on Victrolas prior to 1920 have more unbalanced weight than this one?

A. I cannot say without measuring them.

XQ. 1082. You never made such a measurement?

A. No, I have not made such a measurement. The question of friction is not told in its entirety by the unbalanced weight. A full tone needle produces a good deal larger drag on the record than what is known as a light tone needle.

XQ. 1083. Both types were used prior to 1920, weren't they?

A. Yes. And the ease with which the needle may be moved laterally on this type of pickup would determine very largely the drag that it exerts on the record.

XQ. 1084. You want to make a definite distinction between the drag of a mechanical pickup, such as was used before 1920, and this exhibit?

A. Yes; I should say that the average mechanical pickup had considerably more retarding force than the one you have there.

XQ. 1085. I said as to unbalanced weight.

A. Unbalanced weight is only one of the factors that enters into it.

Mr. Ashton: Will you repeat the question, please?

XQ. 1086. (Question repeated.)

A. You have asked me as to the drag due to unbalanced weight. Unbalanced weight is only one of the factors.

XQ. 1087. Name the other factors.

A. The flexibility of the sideways motion on the needle. That is, the load which the reproducer puts on the needle.

XQ. 1088. That is different in the two cases, is it?

A. It usually is, yes.

XQ. 1089. Is it in this particular case that we are referring to?

A. This particular pickup is made up to have a minimum lateral load on the vibration of the needle, yes.

XQ. 1090. How do you know that?

A. I have seen descriptions of this oil damp pickup in the press.

XQ. 1091. Point it out to me on it.

A. What do you wish me to point out to you?

XQ. 1092. Just what you said a moment ago. I don't know what it is.

A. That the construction of this is purposely made so that it does not wear the record?

XQ. 1093. Yes.

A. There is no way of pointing it out to you without disassembling the pickup. That is one of the criteria of good pickup design.

XQ. 1094. And I suppose the Victor Company ignored that completely prior to 1920?

MR. WARD: I object to that.

A. It certainly was evident in a great many cases by the very rapid wear that this mechanical pickup made on the records. They did not last very long.

XQ. 1095. Can you estimate the weight of the mandrel of the Edison machine Exhibit 31?

A. It would be a pretty difficult thing to do.

XQ. 1096. Is it a solid mandrel?

A. The shaft itself appears to be solid. I am not sure that it is, because I have no means of determining it.

XQ. 1097. You cannot tell whether the mandrel is solid or not?

A. Do you mean the cylinder here?

XQ. 1098. That cylinder, yes.

A. It is not entirely solid. The thickness of the brass is, I should say, probably three-sixteenths of an inch by looking at the hole at one end of it, and the thickness of the brass here (indicating) is probably three-sixteenths or one-quarter of an inch, if this thickness on the smaller end represents the thickness of the entire mandrel.

XQ. 1099. Estimate its weight.

A. It is a pretty difficult thing to do that. I have no idea in pounds and ounces how much it does weigh, because I do not even know what proportion of it is solid. It is quite considerable, of course.

XQ. 1100. It is quite considerable. You had no hesitancy in stating on your direct examination that this type of machine without a flywheel on could not be driven smoothly so as to avoid speed variation?

A. Did I so state?

XQ. 1101. I believe you did. I don't know what the purpose of your testimony was unless it was that.

A. Will you refer me to my testimony?

XQ. 1102. You are supposed to have it in mind. You know that our time is limited this morning.

MR. WARD: I object to that.

THE COURT: Just refer him to his testimony, or refer him to the fact.

XQ. 1103. I am referring to this machine, the Edison Triumph model.

A. Will you repeat the question?

(Question repeated.)

A. Without referring to the previous testimony, the speed at which the cylinder is driven depends on many factors. It depends on whether irregular loads are connected with it, whether the motor which drives it is in regular operation, and various other factors. The weight of the cylinder alone of course cannot produce speed constancy.

XQ. 1104. You are very sure of that?

A. If you don't have any motor in here, of course you cannot have speed constancy of the cylinder.

XQ. 1105. If you don't have what?

A. The mere fact that this cylinder weighs three or four pounds does not insure speed constancy if there is no motor inside.

XQ. 1106. Are you assuming that there is no motor to drive the machine?

A. I thought your question was whether or not the weights of the cylinder insured speed constancy.

XQ. 1107. I am speaking of the weight, the same as you testified.

A. As pointed out in the patent, the moment of inertia of the record carrier does have an effect in smoothing out the speed.

XQ. 1108. What do you refer to as the record carrier? It is not the record itself?

A. There is a distinct difference between a phonogram carrier and a record carrier, and the patent makes that very clear, to my estimation.

XQ. 1109. Tell me how large you would have to make this cylinder in order to make it give uniform speed.

A. To answer that question you will have to tell me what degree of uniform speed you are considering and what degree of non-uniformity is present in the driving means. It is a totally unanswerable question.

XQ. 1110. Assume anything you want, and tell me on your own assumptions.

A. If there is no——

XQ. 1111. We are talking of the machine as it is and as you have testified about it.

MR. WARD: With all of the stuff that is operative here?

MR. ASHTON: Just as the machine is here. If you will let me go on, we will get through.

THE COURT: The machine is right there.

A. Will you repeat the question. I don't think it is answerable in its present form.

(Question repeated.)

A. To get a mathematically perfect uniform speed, if there are any fluctuations present in the system, you would have to make it of infinite size, and the size depends upon what you mean by "uniform speed." If you mean commercial uniform speed——

XQ. 1112. That is what I mean right there: commercial uniform speed.

A. It depends entirely on what you call uniform speed.

XQ. 1114. You have already stated commercial speed.

A. How large the cylinder would have to be made to get a uniformity of speed which would be acceptable in connection with motion pictures?

Q. 1115. Such as you have testified about the patent in suit gives.

A. That is a rather difficult question to answer.

XQ. 1116. If you cannot answer it, just say so.

A. Not knowing to what degree of uniformity of speed is implied or meant——

XQ. 1117. You have already stated, commercial uniformity.

A. Speed fluctuations that were perfectly acceptable for home recording would be totally out of the question in a theater.

XQ. 1118. We are talking about in a theater, as you know.

A. That is a matter of mathematical computation. With all of the factors involved, it would take probably several days for me to figure the thing out.

XQ. 1119. You have no opinion?

A. I don't want to give an opinion without having something back of it.

XQ. 1120. If you put as much mass as in the Defendants' Exhibit machines PS1 and PS16 on there, would you have a speed uniformity then?

A. It would depend entirely on the driving mechanism.

XQ. 1121. Here is the driving mechanism, just as in Exhibit 33.

A. I don't know if the motor would even be able to drive the shaft if it were as heavy as that exhibited in the defendants' apparatus.

XQ. 1122. Take the PS16. How much does that flywheel weigh?

A. I have never weighed it.

XQ. 1123. Would that much mass added to the surface of the cylinder on Exhibit 33 without the flywheel give uniform motion?

A. It depends entirely on how you add it. If you spread it out——

XQ. 1124. Spread it out?

A. I am not able to answer your question. That is purely a matter of mathematical computations. If you give me the time I will give you an answer. I don't want to risk something that I have not computed.

XQ. 1125. Will you state the limits in which you would say that the flywheels might be varied on the

alleged infringing machines, and still give commercial uniform speed?

A. That depends entirely on the irregularities in the drive or the irregularities in the system.

XQ. 1126. You know what is in the system?

A. If there are no irregularities, there is no necessity for a flywheel.

XQ. 1127. We are talking of practical machines, PS1 and PS16, which you have testified about in this case.

A. That is a wholly unanswerable question. For instance, the PS16 machine, according to defendants' pamphlet, is supplied with several different types of motor drive.

XQ. 1128. Take the motor drives we have here, Please don't change when we are pinning it down to a definite machine.

A. You are asking me a very broad question and trying to pin me down to some specific set of conditions which I do not understand.

XQ. 1129. I am asking you about definite machines that we have exhibited here during this trial, and the motors on them, and everything else is definite.

A. I would hesitate to say between what limits the weight of the flywheel might be varied.

XQ. 1130. Do you find anything in the patent in suit about that as to the limits?

A. It says that it is a flywheel of large mass.

XQ. 1131. Does it state how large it should be?

A. Yes. As I have already pointed out, it is described as a flywheel of large mass, and its dimensions may be computed from the drawing.

XQ. 1132. Does the lower limit involve more mass than is in the flywheel on Exhibit 31?

A. I think a comparison is entirely immaterial and unfair, because the amount of energy stored in the fly-

wheel depends upon the speed of rotation. This shaft does not revolve at the same speed as the motion picture projector.

XQ. 1133. Assume the same speed as in PS16. Would this flywheel of the Edison machine do the work?

A. Without having made a test, such conjectures are entirely worthless.

XQ. 1134. You would not care to state?

A. No, I would not care to state.

XQ. 1135. Then your opinion as to the lack of uniformity in the drive in this Edison machine Exhibit 31 is based not upon the amount of mass which is used in this machine?

A. I have never heard the Edison Triumph machine, the modified Triumph model, demonstrated in the way that it is supposed to be used. Whether or not in this particular machine those wide speed fluctuations are there or are only minor speed fluctuations, is beyond my power to answer.

XQ. 1140. You are unable to answer what the limits are of the mass which would be necessary in order to give commercially uniform speed in our machine PS16?

A. Mass is only one factor involved. The question of speed and the speed of the rotation of the shaft and the location of that mass. If it is located near the center of the shaft it is an entirely different thing, it has an entirely different effect. I think that is an entirely unfair question.

XQ. 1141. You are making assumptions which do not exist. I said the PS16 machine. Can you think of that machine and talk about it?

A. Yes.

XQ. 1142. Is the question now clear?

A. You said "mass." Mass is not synonymous with moment of inertia.

XQ. 1143. Distributed in any way you will.

A. If I had a small mass located at a very large radius of gyration, it would give the same flywheel effect as a very large mass with a very small radius. Your question is totally unanswerable as far as I can determine, from a technical standpoint.

XQ. 1144. Would it help you if we just varied the thickness of the flywheel, and that is the variation. Would that help you?

A. That would make it a little more definite.

XQ. 1145. Will you try that?

A. You want me to say what the minimum thickness of the flywheel should be to accomplish these results?

XQ. 1146. Commercial uniform speed.

A. Without having made tests in that direction, I cannot answer that question.

XQ. 1147. You find nothing in the patent about that, do you?

A. The patent does not say what—No, there is nothing in the patent which states that.

XQ. 1148. I want to direct your attention to the mechanical reproducer. Take, for example, the reproducer, on the Kinetophone, Defendants' Exhibit 11. My recollection of your testimony is that the mechanical pickup of the type of this exhibit will introduce serious speed variations: is that your testimony?

A. Without having referred to it, I cannot say whether it was or not. I now testify that any mechanical pickup introduced some irregular friction in the driving of a cylinder record.

XQ. 1149. Have you ever made any quantitative tests to determine what that amounts to?

A. No. I have only noted it in a practical way. I have noticed from the speed drops that when a loud note is struck it is quite noticeable in many cases.

XQ. 1150. Will you state exactly what you had to do with phonographs before you began work on this case? And I mean by "phonographs" phonographs similar to the two Edison machines, the Kinetophone and the Triumph machine, in which cylindrical records are used.

A. Of course, I have had a cylinder machine for a good many years, and played with it as a child, and recorded records on it and reproduced them. And lately we have been much interested in the university in recording on disc records, and have made hundreds of such records and reproduced them, of course.

XQ. 1151. Did you ever make any measurements during this period when you were working with phonographs and playing with them?

A. Not as a child. No, I did not. I of course made measurements of the recent disc recording.

XQ. 1152. The impression which I get from your testimony regarding these electrical pickups which were used in the defendants' demonstration is that you have been apparently unable to appreciate the testimony of Mr. Waterman, in which he stated that the purpose of those demonstrations was to avoid every source of speed variation excepting what might be due to the motor drive. Have you had any such difficulty?

A. I did not understand Mr. Waterman to mean that, because he has deliberately substituted for mechanical stylus a device which to my mind gives less friction on the record and would eliminate irregularities which might be otherwise produced by the mechanical stylus.

XQ. 1153. Are you prepared to say, Professor Ballard, that the unbalanced weight of the electric reproducers is of a different order than the mechanical reproducers?

A. I did not so state.

XQ. 1154. Are you prepared to state?

A. Of a different order?

XQ. 1155. Of a different order, yes.

A. No. I make no such statement of that character.

XQ. 1156. Would you state that they were not?

A. They are both of the same order; they are less than ten pounds; they do not go into tons; it is a matter of ounces, yes. In that respect they are of the same order.

XQ. 1157. Would the variations introduced by one type and the other be of a different order?

A. Yes, I think it is quite generally accepted that a mechanical stylus puts more of a load on the record than an electrical pickup does.

XQ. 1158. A different order?

A. Very much different in amount, yes.

XQ. 1159. Did you answer yes?

A. I did not answer yes, of a different order, because I don't know what you mean by a different order. It is all in grams and ounces.

XQ. 1160. "A different order" is a common term, isn't it?

A. I would not say it was the same order. It is different in amount.

XQ. 1161. Would you say that this is a fair statement: that in the case of cylindrical records, these all being of the hill and dale type, the stylus rests on the record by the pressure of a small weight suspended below the diaphragm housing, and this weight is so mounted that the stylus may ride sideways or up and down and follow the record groove with a gentle pressure.

A. That of course would not be true in the case of recording, because there the stylus has to press with a very definite pressure on the record in order to get a record.

XQ. 1162. In reproducing?

A. In reproducing the stylus does press on the record and some friction is produced, yes.

XQ. 1163. Does it press gently?

A. It depends entirely upon the way the equipment is operated. It depends on what you mean by "gently."

XQ. 1164. Will you take some specific example of a hill and dale reproducer which you can think of, and answer my question as to whether the reproducer presses gently or not, and if you say that you cannot say whether it was gentle or not, give the amounts in grams or whatever measure you want, that is involved.

A. The stylus reproducer, as has been very aptly pointed out in connection with the Watson record, presses on the record with enough pressure so that it wears the record down.

XQ. 1165. Does it press on enough to introduce substantial variations?

A. In my estimation, yes. There is a variable friction load pressed on the cylinder, due to the fact whether a sound is being reproduced or not.

XQ. 1166. State the amount of this pressure.

A. In what specific case?

XQ. 1167. The one that you just referred to will do. The Kinetophone.

A. I am referring to no specific case. I am talking in generalized terms.

XQ. 1168. Take Exhibit 11, the Kinetophone. Have you felt that stylus to see, and will you please do it if you have not?

A. (The witness complies.)

XQ. 1169. Give us some figures now.

A. I cannot tell you how many pounds of pressure or ounces of pressure are exerted by merely

pushing it up with my finger. I notice that a considerable pressure is present.

XQ. 1170. You cannot do that with the electric reproducers either?

A. No, I cannot judge the weight of the pressure merely by pushing up with my finger.

XQ. 1171. And you have made no attempt, before giving your testimony, to make measurements of that?

A. I had no idea that this type of reproducer was going to be used. I was very much surprised when I saw that the normal type of reproducer had been discarded and some other type used in place of it.

XQ. 1172. But you knew it last week when we gave our demonstrations?

A. Yes.

XQ. 1173. You had plenty of time, didn't you, to get quantitative data if you had wanted to?

A. I started fingering around and was told by Mr. Waterman to keep hands off.

XQ. 1174. Around what? Were you told to keep off of this reproducer which was used on the General Phonograph and on the models in which film was used?

A. I made no attempt to do that, because I was examining the model which you call the Reel Film, and I was asked by Mr. Waterman to please not touch it.

XQ. 1175. My information is, Professor Ballard, that you were told by Mr. Waterman that you could weigh those pressures if you wanted to. Do you dispute that?

A. Mr. Waterman, as far as I know, made no such statement to me. He may have made it to someone else.

XQ. 1176. Did you ever request or did your counsel ever request an opportunity to make those measurements other than this instance which you have referred to?

A. No, I think not.

XQ. 1177. And you have made no attempt to get such data?

A. As to the relative unbalanced weight in the two cases?

XQ. 1178. Yes.

A. No, because I don't think it is a controlling factor.

XQ. 1179. Now you are prepared to say that it is not a controlling factor as to speed variations?

A. It is not controlling as to speed variations. There are many other contributory elements——

XQ. 1180. You know perfectly well that it is not controlling at all, and that it has no such influence?

A. I know directly to the contrary.

XQ. 1181. And you are prepared to say that this hill and dale pickup on Exhibit 11 would influence the speed of this heavy flywheel and motor drive on this machine?

A. From a theoretical consideration and from a practical consideration, yes.

XQ. 1182. From both?

A. Yes.

XQ. 1183. You have no data upon which to base that except your own opinion?

A. It is not a question of opinion. It is a very simple matter to see that a stylus moves with less friction over a smooth groove than it does over a rough groove. Anyone skilled in the art knows that.

XQ. 1184. Assuming an ordinary record, such as the Minstrel record used the other night: were the variations so introduced ones which you could detect?

A. I heard a very distinct souring of the note——

XQ. 1185. Could you testify that what you heard was due to the stylus on the record?

A. Of course, that would have been impossible, because there were a number of contributory causes.

I don't know what percentage the friction of the stylus had, and what percentage the friction irregularities in other parts of the equipment had.

XQ. 1186. Then you don't know that what you heard was due to the stylus, do you?

A. No, of course not. I merely know that there is a variable friction load due to the stylus. But what percentage is produced by the stylus in comparison with the total irregularities, I am unable to state.

XQ. 1187. (Reading): "The diaphragm and weight are so constructed that any sound wave of proper amplitude or loudness will be followed by the stylus and properly reproduced." Do you agree with that? We are talking now, you understand, about hill-and-dale records, with a mechanical stylus of the type such as is used on the Edison Kinetophone, Exhibit 11, or on the Edison Triumph machine.

A. That is merely a matter of degree. We know very definitely that the stylus does not follow exactly the record, nor does it transmit to the diaphragm the exact motion recorded.

XQ. 1188. It approximates it pretty closely, doesn't it?

A. To a greater or less degree, depending upon what conditions may exist.

XQ. 1189. If a sound is too strongly recorded, due to failure, for example, to properly control the voice or music, the reproducing stylus and floating weight would do what is termed "float," would it not?

A. Are you making this statement?

XQ. 1190. I am asking you if that is a correct statement.

A. I don't see that it necessarily follows at all.

XQ. 1191. What would happen?

A. If it is too heavily recorded?

XQ. 1192. Yes.

A. You would have to define what you mean by "too heavily recorded." Too heavy for what?

XQ. 1193. A record which had too heavy notes on it. You can assume any record you want.

A. That is the particular case in which the cutting is so deep that it is impossible for the stylus to follow it?

XQ. 1194. No. I told you that the amplitude of the record was so that the stylus could not follow it. I understood you to say that when heavy notes appear on these phonograph records, that that slowed up the machine: is that your testimony?

A. That there is a greater friction load of the stylus when loud sounds are reproduced, than others?

XQ. 1195. Yes.

A. What I have stated in the last answer represents the facts.

XQ. 1196. That is what you meant in giving that testimony. Have you ever heard of a greater pressure of a stylus on a record than one and a quarter ounces?

A. Yes. The pressure used for recording in disc records that we made is considerably above that point.

XQ. 1197. Disc records that who made?

A. That we now make at the university.

XQ. 1198. I confine it to wax cylinders.

A. I should think would depend very largely upon the quality of the wax you are using. If you are using a very soft master wax, that is one thing. If you use a commercial wax, used in the Dictaphone, it is entirely different. The question is entirely unanswerable.

XQ. 1199. I understood that we were agreed that we were talking about records such as would be recorded for cylindrical phonographs.

MR. WARD: Wait a moment. Your Honor, I think this is a very unfair line of questioning. Mr.

Ashton is reading from something here. Does it relate to recording on soft wax records, or some commercial hard record?

MR. ASHTON: My particular question relates to wax recording on Edison phonographs.

THE WITNESS. To the recording?

XQ. 1200. Yes.

A. That would depend entirely on the consistency of the wax used.

XQ. 1201. Did you ever hear of more than one and a quarter ounces being used?

A. I don't know what pressure is used. I should judge that it is related to the softness or the hardness of the wax used. The compositions of recording wax have changed materially in the past few years.

XQ. 1202. Did you make any point or do you make any point of the fact that as shown in the early German patent of Vogt, Massolle and Engl, the film gate is not shown as touching the film?

A. I believe I so stated in some of my testimony, that in the drawing the film gate does not touch the film.

XQ. 1203. I ask you if you made any point of that fact in connection with the disclosure of the German patent.

A. I made a statement that such was the case.

XQ. 1204. Is it your position that a pressure gate is not disclosed in that patent?

A. It does not seem to me that anything is very definitely disclosed there, as far as the gate is concerned. They are merely guide strips.

XQ. 1205. Have you examined the gates of the simplex projectors which were testified to in this case?

A. No, I have not. I am fairly familiar with the gate of the Simplex projector, however.

XQ. 1206. Will you examine this Simplex gate which is taken from the No. 100 machine?

A. Yes.

XQ. 1207. Will you also look at the Simplex catalogue, Exhibit 2. Is the gate which I hand you shown on page 11 of that catalogue?

A. It seems to be illustrated there, although I cannot very definitely see. This seems to my mind to be representative of a Simplex gate.

XQ. 1208. You notice the pressure pads on that gate, don't you?

A. Yes, I noticed that very light pressure was applied to the guiding strips.

XQ. 1209. Very light, is it?

A. Well, they are very light in comparison with the defendants' early German patent model, yes. Distinctly light.

XQ. 1210. Did you examine the gate on the Powers machine?

A. No, I did not.

XQ. 1211. Or on the Edison Kinetoscope?

A. No, I did not.

XQ. 1212. You know that they have similar pressure pads, do you not?

A. Yes; they are pressure pads holding the film lightly in place at the point at which the picture is projected.

MR. ASHTON: I am talking about the Powers projector and the Edison Kinetoscope.

XQ. 1213. You don't question the fact that the German patent says that the film should be guided, do you?

A. No, I have had a little difficulty in getting the correct translation of the word "fuhrungsleisten," and in talking to some of my friends who have a better knowledge of German than I have, they have told me

that this word signifies to their mind a guiding to prevent sidewise motion. The definition of the word "leisten" seems to be somewhat of a channel, as it were, to prevent sliding motion sideways.

XQ. 1214. If you were told to guide a film prior to 1920 in a motion picture machine, what would you use?

A. It would depend upon for what purpose the guiding was to be done; merely to carry it down through the machine to prevent lateral displacement, I might put in a pair of parallel guides,

XQ. 1215. To guide it so that light for reproducing sound could pass through?

A. I think I would probably put some sort of mechanism there. I cannot say definitely what I would use, because it depended entirely upon what results I wanted to get.

XQ. 1216. Did you know of pressure gates in motion picture projectors prior to 1920?

A. Yes.

XQ. 1218. It would not occur to you to use the ordinary picture gate, would it?

A. Not an ordinary picture gate, because an ordinary picture gate would not have allowed the reproduction.

XQ. 1219. Would it occur to you to use a pressure gate of any description?

A. I might have experimented and tried to find out what might be suitable. I don't think it is very obvious.

XQ. 1220. You don't think it is very obvious?

A. No.

XQ. 1221. You heard Dr. Engl's testimony, didn't you, that the German patent drawings of this early German patent were diagrammatic?

A. I don't remember that testimony at the time.

XQ. 1222. Do you think that they are diagrammatic?

A. Yes, I think they are diagrammatic.

XQ. 1223. Then why did you talk about scale?

A. Because a diagrammatic drawing shows things. The property of scale comes into a diagrammatic drawing to a certain extent; of course not necessarily an exact scale.

XQ. 1224. We can use that as a principle in this case, can we, according to your opinion?

A. For what?

XQ. 1225. For judging all drawings in the case.

A. Judging all drawings in the case?

Mr. Ward: All drawings of patents that everybody put in the case?

Mr. Ashton: Any drawing.

A. I don't see why it should be universally used under every condition, no. Circumstances alter cases.

XQ. 1226. You would not apply it generally?

A. I might and I might not.

XQ. 1227. You testified that there were some rough spots on this German model. I wish you would point them out for me.

A. There are what are apparently rough ridges, at least they were not polished. Here (indicating).

XQ. 1228. Try and feel them.

A. They do not seem to be as highly polished as the rest of the roller.

XQ. 1229. Are you talking about the place where a channel is cut?

A. Yes.

XQ. 1230. Any other rough spots?

A. A similar series of conditions seems to exist on the lower roller. I was referring to the upper roller previously.

XQ. 1231. You can feel those there very easily?

A. Yes, I can feel roughness by moving the finger back and forth across the roller.

XQ. 1232. You feel the depression, don't you?

A. Yes.

XQ. 1233. You feel rough spots besides that?

A. Rough spots?

XQ. 1234. Yes.

A. I feel that there are ridges on this roller, sharp ridges on the roller.

XQ. 1235. And you think those ridges are higher than the rest of the roller, do you?

A. They are certainly higher than the part of the roller which immediately adjoins it.

XQ. 1236. That is, the channel?

A. The edges of the smooth part of the roller are certainly higher than the depressions, yes.

XQ. 1237. You pointed to some rough spots on the gate too, didn't you, in your direct testimony?

A. There are two depressed slots cut in the gate, and the chattering of the tool which cut them can be very distinctly seen.

XQ. 1238. Where the film would strike it?

A. In all probability the film is pressed down into contact with these rough spots by the strips of fiber located on the top of the gate. It is quite easy to see the chatter marks of the milling tool that was used to put these slots in the lower part of the gate.

XQ. 1239. These rough spots you have testified would introduce friction?

MR. WARD: May I insert here that you are referring the witness to the defendants' model of the first German patent, Exhibit 78?

A. The rough spots would probably be very soon smoothed out to a very high polish with any considerable amount of film that had been run through it. That seems to be the case here.

XQ. 1240. It is very unimportant.

A. I don't think that the slight roughness that is present on those rollers is very important one way or

the other. The great amount of the friction is of course due to the inordinate spring pressure with which the two heads of the gate are pressed together.

XQ. 1241. You are not suggesting that this has been changed since you saw it the other day?

A. No, not intentionally. I think perhaps the running of the film through it has a tendency to smooth up the rough spots.

XQ. 1242. The pressure rollers pulled the film through in spite of this roughness, didn't they?

A. Oh, yes. That is, the feed sprocket pulled it through. The pressure rollers did not pull it through.

XQ. 1243. The film went through?

A. The feed sprocket at the lower end of the apparatus pulled it through, yes.

XQ. 1244. Do you think the flywheel slipped when it was pulled through, in spite of this friction?

A. It may have slipped to some extent while it was coming up to speed. The tests seemed to indicate that there was no great amount of slippage after the machine got in operation.

XQ. 1245. So if we put rough spots on this arrangement, on the rollers and on the film gate, we introduced more friction?

A. I said nothing of that character.

XQ. 1246. I show you two films and ask you if you can see any difference in the emulsion in the short lengths at the end without unrolling all of the film. Any difference in the condition of the emulsion?

A. It is very difficult to say anything about the emulsion on this film, because there is no picture on the film.

XQ. 1247. There is an emulsion on it, isn't there?

A. Most of the active photographic material—there is no active photographic material on, except to make the sound record,

XQ. 1248. What is left when you develop a film that has not been exposed?

A. The film base and a certain amount of the emulsion, transparent emulsion.

XQ. 1249. When you testified that the emulsion would be injured in this German model did you have in mind such emulsion as is on that film as it is now?

A. I had in mind the practical ordinary case of a picture record occupying its normal position on the film.

XQ. 1250. Only the picture record?

A. The picture record and such other parts as may be affected by the rollers.

XQ. 1251. How about the sound records? Do you see any injury to that emulsion?

A. There are one or two scratches on the film here. They may have been made in the same way, or in another. It is not perfect.

XQ. 1252. Look at this one.

MR. WARD: Your Honor, I would like the record to show that this film is full of oil on the surface of it. As I run it through my hands you can see it on my fingers.

A. There are two long scratches on this film which I did not notice on the other film, and there seems to be abrasion of some character present in this film that is not quite as visible in the other film. Long parallel scratches.

XQ. 1253. Is the emulsion injured?

A. The scratch, of course, would indicate that some effect had been made upon the emulsion. If the picture were there it would indicate a scratch across the picture.

XQ. 1254. This is the sort of thing that you were talking about when you said that the early German model would ruin the emulsion on the film, is it?

A. There is no picture there to show what would happen if normal film were used.

XQ. 1255. How about the sound record?

A. It is pretty hard to say much about the sound record——

XQ. 1256. You know, don't you, that the emulsion is not seriously injured on this film?

A. I see scratches on the film. I should think if such device were producing the scratches, and were used many more times, the picture would be very seriously damaged.

XQ. 1257. Where would the scratches that you referred to in your direct testimony occur?

A. I did not say anything about scratches. I said hurting the emulsion.

XQ. 1258. You were not talking about scratches at all?

A. A scratch of course is an injury to the emulsion.

XQ. 1259. Is the emulsion injured in the sense that you spoke of in your direct examination as to this film?

A. A scratch on the emulsion would injure it in the sense that I had reference to.

XQ. 1260. Then you were only talking about scratches in your direct testimony?

A. Scratches and other damaging contacts.

XQ. 1261. Do you find any of the other damaging contacts on this film?

A. There is no picture there and no way of seeing.

XQ. 1262. You criticized the German model because of the pivot, didn't you, the pivot of the roller?

A. I said that this construction was not illustrated in the patent by which the roller was pressed on in pivoted condition.

XQ. 1263. In mounting rollers prior to 1920 was it customary to put pivots of this character in them?

A. In what kind of rollers?

XQ. 1264. In any kind where you had to drive something between them. Take, for example, paper mills.

A. I am not familiar with paper mill practice.

XQ. 1265. Do you know of any instance where it was done?

A. Certainly in rolling mills they do not have any pivots between the rollers. They are directly lined up parallel.

XQ. 1266. Do you know of any instance prior to 1920 where the pivoted roller of this type was used?

A. I don't think of any at the moment. Of course, there may be some, if you will give me a chance to think.

XQ. 1267. You don't remember any?

A. I don't think for the moment. It is not an unusual mechanical construction.

XQ. 1268. Was it customary prior to 1920 to use spring pressure with two rollers between which something was to be fed?

A. I don't know that it was customary. There were undoubtedly many cases where strips to be fed at spring pressure was produced between the two rollers.

XQ. 1269. They even do that in a clothes wringer. don't they?

A. A clothes wringer?

XQ. 1270. Yes.

A. I am not an expert on laundry practice.

XQ. 1271. Did you ever see a clothes wringer with that arrangement in: two rollers coming together, pushed down by a spring on each side?

A. Yes.

XQ. 1272. I would like you to state whether you were given an opportunity to use the stroboscope when you examined the defendants' machines subsequent to the defendants' demonstration?

A. I was not given an opportunity. The stroboscope was not called to my attention. I think it was without any opprobrium on the part of the defendants, because I understood other members of our party had that particular thing demonstrated to them. I saw that it was present, but I did not see it in operation.

XQ. 1273. You could have placed it on this German machine model if you had wanted to, could you, Exhibit 78? You could have applied it, couldn't you?

A. A stroboscope used in connection with it, yes.

XQ. 1274. And the stroboscope was there available to be used?

A. There was a mercury arc with discharge tube, as I took it to be, mounted on the side.

XQ. 1275. Yes.

A. I think it was the intention of the defendants to demonstrate that, and through no fault of their own I did not see it.

XQ. 1276. That is your inference, isn't it?

A. Yes.

XQ. 1277. If we had demonstrated it, or if you had asked to have it demonstrated, would the stroboscope show exactly show what variations there were in this machine?

A. The stroboscope would show to a limited degree the fluctuations in a flywheel. I don't know what kind of a stroboscope apparatus you had: whether you had a sharp, big illumination, or whether it was merely operated for 60-cycle current. A tube operated on 60-cycle current gives a somewhat blurred line when viewing a rotating flywheel, and does not illustrate always slight speed fluctuations.

XQ. 1278. You referred to the motor which was used on the defendants' machine on which the German model and the model of Figures 3-6 of the patent was demonstrated, as a synchronous motor?

A. I certainly did.

XQ. 1279. You stated that synchronous motors had a tendency to hunt and implied, did you, that that would introduce speed variations: is that correct?

A. I mentioned it before Mr. Waterman to give him an opportunity to substitute for the synchronous motor some other type of motor that did not have hunting characteristics, and he apparently did not take the hint.

XQ. 1280. To substitute?

A. To use the same type of motor that was being used on the PS1 or the PS16, neither of which had synchronous motors.

XQ. 1281. And you did not understand that all speed variations were to be taken out in testing this German model 78, so far as such things as motors was concerned?

A. Yes. That of course would be the ideal condition, which would not be fulfilled by a synchronous motor.

XQ. 1282. What was the motor that was used in the plaintiffs' demonstrations? Have you studied that to see what that is?

A. It is a type SAS motor.

XQ. 1283. Is that a synchronous motor?

A. I am told that it is a synchronous motor. I am not sure of that.

XQ. 1284. You have not bothered to look into it?

A. I had no means—the matter came up only recently.

XQ. 1285. You know that in motion picture studios, two synchronous motors, one to drive the camera and the other the sound recorder, are used?

A. In what system?

XQ. 1286. In any system.

A. No, I know that is not the case. In the Western Electric interlock system——

XQ. 1287. Is it in the R. C. A.?

A. I cannot state definitely.

XQ. 1288. You don't know?

A. I don't know. It probably is.

XQ. 1289. Now, Professor Ballard, you criticized, as I understand it, the bearings used in the models representing the old German patent, and also Figure 5 of the patent in suit, on the ground that cast iron bearings were used: is that right?

A. I know that there are no cast iron bearings in my automobile, as far as I know.

XQ. 1290. Do you know much about cast iron bearings?

A. Yes, I have made a good many of them.

XQ. 1291. I would like to read you a statement:

> "In explaining the making of the shafts for use on the Simplex, they are exceptionally large in diameter and consequently much heavier than those on most projecting machines. All are made of tool steel and, after turning, they are carefully ground to within limits of one five-thousandths of an inch, which insures great accuracy. Where high speed duty is required, they are hardened to minimize wear. These shafts of tool steel revolve in bearings of cast iron unusually long in the center frame."
>
> "Cast iron retains a certain quantity of oil, thereby reducing the friction to a minimum and eliminating the possibility of the shaft getting out of alignment."

XQ. 1292. Do you approve the statement there regarding cast iron bearings?

A. Yes. This seems to me a very specific case where the bearing is extremely long, and is totally inapplicable to the question at issue.

XQ. 1293. I will read you another statement. Both of these statements are from the Simplex catalogue:

> "Cast iron as a bearing metal is recognized the world over as being par excellence. It is semiporous, thereby retaining a quantity of the oil, and causing a glazed surface to be formed by the revolving shafts of tool steel."

Do you approve that?

A. I do not.

XQ. 1294. Here is another authority; entitled "Lubrication and Lubricants," published in 1922 by Buchatt in England. Do you know that book?

A. No.

XQ. 1295. On page 43, under "Cast Iron," it says:

> "Excellent bearing surfaces are made on unchilled gray cast iron. The only objection that can be urged against this metal is that it is rather brittle, especially when heated by friction. It not only works well in contact with steel or wrought iron, but also against itself."

Look at the rest of the statement and tell me whether you approve that. And I also ask you to look at the statement in the American Machinist under date of March 23d, 1911, page 538, and tell me whether you approve that.

A. If I may make a statement in the interests of facilitating the trial, I am willing to admit that cast iron is used as a bearing material where the question of long life and of absolute minimum friction is not essential. Bearings made of cast iron, of course, work; but that is not the same thing which I under-

stand the defendant uses in either of its machines, and I do not think that it represents the best type of bearing. I don't know whether that statement is sufficient for your purposes.

XQ. 1296. Isn't it used where long life and minimum friction are desired?

A. I don't think so at all.

XQ. 1297. I read from the American Machinist:

> "The hardened steel spindle and cast iron will stand as much neglect as any combination of metals, has a much longer life, will retain its accuracy for an indefinite period, withstand intermittent cut or series of blows which would peen out and loosen babbitt and, from our experience, is positively the best and most lasting bearing ever put in a machine tool."

Do you agree with that?

A. No. I know that most machine tools do not have cast iron bearings. Except the cheapest type of them.

XQ. 1298. You examined the machines that are shown in the photographs introduced in evidence here, which are in the Smithsonian Institution, didn't you? The Bell & Tainter machine and others?

A. No, I never saw them.

XQ. 1299. You did not go to the Institution?

A. No.

XQ. 1300. Did you ever see the Bell & Tainter record which is there on the Bell & Tainter machine?

A. The record?

XQ. 1301. Yes, the record strip.

A. No, I have not seen the apparatus. I have not been to Washington.

XQ. 1302. You have not seen the record either?

A. No.

XQ. 1303. Or a piece of it? Did you get a piece of it?

A. That record which the defendants attempted to demonstrate on their apparatus?

XQ. 1304. No, the record that is in the Smithsonian Institution.

A. No, I have not seen that record.

XQ. 1305. Are you prepared to controvert the following, which has been calculated by my assistants——

MR. WARD: I object to that.

XQ. 1305 (Continuing.) "The flywheel effect in the Hoxie machine, the flywheel and the governor together, is equal to 20 pounds at the surface of the film sprocket, while the flywheel effect in the patent in suit is 22 pounds at the surface of the sprocket, based upon the use of the teeth as a measurement of the patent in suit in Figure 3."

MR. WARD: Are your experts including the ball governor as a part of the flywheel?

MR. ASHTON: Including the machine exactly as it is here in court.

MR. WARD: You have taken the weight of the ball governor and are using that as a part of the flywheel?

A. The question has no significance to me, because as I have already pointed out, the pulley cannot act as a flywheel because it is limited in its motion by the action of the ball governor.

XQ. 1306. So that your opinion is that it does not act as a flywheel at all?

A. That its flywheel effect is immaterial in the control of the speed in the Hoxie machine.

XQ. 1307. Don't the flywheel and the governor act together on this machine? Aren't they in effect tied together?

A. They are geared together, but they do not act together as a single flywheel, no.

XQ. 1308. There the flywheel effect is not together? They do not act together as a flywheel?

A. The speed governor definitely prevents the pulley from changing its speed, thereby preventing it from acting as a flywheel.

XQ. 1309. Your opinion is that the governor and the flywheel do not jointly produce a flywheel effect in that machine?

A. The pulley has some flywheel effect. That is true.

XQ. 1310. The governor has none?

A. The governor has some moment of inertia, but it is——

XQ. 1311. There is a great deal, isn't there?

A. The governor has some moment of inertia when it is rotating, but seriously limited by the friction, the variable friction which is produced on the pressure pads, and therefore it cannot act as a real flywheel here.

XQ. 1312. It acts as an unreal one?

A. If you will define what an unreal flywheel is, I can tell you.

XQ. 1313. You used the term "real flywheel."

A. It does no thave the effect that the defendants' machine and the patent in suit has.

XQ. 1314. Will you examine the grease which is on the edge of this photograph and tell me whether that is fairly representative of the grease which was used in the defendants' machine of Dr. Engl, which is alleged to represent the patent in suit in Figure 5.

A. There is only a very small portion here, about as big as a match head, and it looks as if it might be the same grease used.

XQ. 1315. Would that have any damping effect if placed on various moving parts in which the flywheel and sprocket were mounted?

A. It would tend to reduce the friction of the shaft, yes.

XQ. 1316. You know the shaft was very tight, don't you?

A. No, I don't think it was abnormally tight.

XQ. 1316a. Wasn't it?

A. No.

XQ. 1317. How long do you think it would wear in the condition in which it was, in a practical motion picture theater?

A. If properly lubricated, I should think it would have a very long life. It was not unduly tight. The fittings were close, as is customary in close mechanical work.

XQ. 1318. Grease cups force grease in there, don't they?

A. Yes.

XQ. 1319. Is this the type of grease that is used on the defendants' machine in connection with the viscous damping? Or is it heavier than that?

A. I don't know. I believe the specifications say, using Alemite grease. I don't know exactly what grade of Alemite grease was used.

XQ. 1320. You have not determined that?

A. No.

XQ. 1321. I want you to quickly compare your machine with the patent in suit and state the resemblances, if any, and the differences.

While they are bringing the machine over I will ask you this: Did you ever see a copy of the Rules of Practice of the Patent Office?

MR. WARD: I object to that. He is not a patent expert or anything like that.

THE COURT: I don't know what he wants. I will allow the question. This is cross-examination.

A. I have seen them, but never studied them.

XQ. 1323. I would like you to look at the copy of the Rules of Practice of the Patent Office, dated April 1st, 1892, which I have here, and ask you if the specifications there disclose and describe a flywheel.

MR. WARD: I object to that as irrelevant and immaterial.

THE COURT: It may be, but I will allow it as part of the cross-examination.

A. You are referring now to this Item No. 13 for a machine?

XQ. 1324. And picture.

A. I will have to read it through. It is somewhat lengthy. It apparently shows and describes a flywheel.

MR. ASHTON: Now will you repeat the previous question.

XQ. 1325. (XQ. 1321 repeated.)

A. If you will tell me just what you want. Do you want me to go on over the whole machine, or some particular points? I will be glad to co-operate with you.

XQ. 1326. First, as to the relative sizes of flywheel and sprocket. Just compare them.

A. This is a twenty-four-tooth sprocket, which should be around one and a half inches in diameter, and the flywheel shows—I don't know the dimensions.

XQ. 1327. You understand that in making this comparison you are using the sprocket teeth of the patent in suit as a basis for size?

A. I did not understand that.

XQ. 1328. Please do that.

MR. WARD: In that case, I object to the question as wholly irrelevant and immaterial. He is trying to get a dimension comparison between pat-

ent drawings and a machine, by taking the sprocket teeth of the film on one wheel as a comparison for the size.

MR. ASHTON: That is the basis which the witness used in saying that he could scale the machine. My understanding is that this machine was put in as an example of Figure 5 of the patent in suit. Is that right? Made under the patent?

MR. WARD: Just what the evidence shows on it.

MR. ASHTON: I am asking you if it is not true.

MR. WARD: Figures 3, 4, 5 and 6. Those four figures together.

THE COURT: I am going to allow the testimony. I wish you would go right ahead now and let the witness answer. He is able to take care of himself.

A. I see a toothed sprocket mounted on the same shaft with a flywheel, and this flywheel is driven through an arm through interconnection of a coiled spring. There are stops provided on the flywheel which limits the motion of the spring.

XQ. 1329. So far is that true of the patent in suit?

A. Yes, as far as the essentials are concerned.

XQ. 1330. How about the shaft?

A. This shaft and sprocket were made in one piece for mechanical purposes, which is, as far as I know, an exact equivalent of what is shown in the patent.

XQ. 1331. But there are two shafts in the patent, aren't there?

A. There is only one shaft on which the flywheel and the sprocket is mounted.

XQ. 1332. The shaft is broken in the patent, isn't it?

A. Yes, the arm is mounted in a slightly different way than shown in the machine, for mechanical reasons.

XQ. 1333. For damping reasons?

A. No.

XQ. 1334. Please continue.

A. In order to prevent an inordinately long arrangement of putting the arm directly in line with the shaft, a sleeve is provided protruding from the housing of the machine over which the gear operates. This sleeve prevents contact between the gear and the shaft on which the flywheel and sprocket are mounted.

XQ. 1335. Is that sleeve shown in the patent?

A. That is an obvious deviation for mechanical purposes, which would be immediately self-evident to anyone skilled in the art.

XQ. 1336. The transfer, I suppose, of the gear also in between the arm and the flywheel would be obvious to one skilled in the art, would it?

A. I should not think that there would be any inventive ability required to do that. Yes, that is distinctly within the province of a mechanic.

XQ. 1337. Any other differences? How about the size of the flywheel?

A. There is about a three-to-one relation between the diameter of the sprocket and the diameter of the flywheel, roughly speaking.

XQ. 1338. How does that compare with the patent?

A. The patent I think shows, from a rough guess, about two and a half to one.

XQ. 1339. Are you sure that it is two and a half to one?

A. No, I am not sure, but I just scaled it off, roughly.

XQ. 1340. Do you want to change that?

A. No, I think it is about three and a half to one. It may be more.

XQ. 1341. We can tell from the machine itself. Never mind. How many teeth would there be on the sprocket of Figure 6 on the basis that you have used that sprocket?

MR. WARD: I object to that as wholly irrelevant and immaterial. It is a matter of detailed design from a patent drawing.

MR. ASHTON: That is what he said in his direct testimony.

THE COURT: Overruled.

A. On the basis of what dimensions?

XQ. 1342. The one you used in your direct testimony, which was the teeth, as I understand it, on the sprocket, in the patent.

A. I used that merely to correspond to some computations which Mr. Waterman had made, and without any indication that that was the controllnig factor.

XQ. 1343. You uscd it in your prima facie testimony, didn't you?

A. Yes, to correspond with the testimony that Mr. Waterman gave.

XQ. 1344. His testimony came later, did it not?

A. No, I think not. Of course, the sequence of the testimony is established by the record, which will show it.

XQ. 1345. Now, as to the size of the spring. Was the spring that you used in the first demonstration a few nights ago the same spring that you used last night?

A. I am informed that the springs in each case were designed to overcome the friction, in accordance with the teachings of the patent, and that a different spring was used in the two cases, because a different amount of friction was present.

XQ. 1346. That is, you had some more friction the first night than you had the second: is that right?

A. I think there was some variation.

XQ. 1347. And what was that due to?

A. I really don't know, because new gears were substituted, and it might have been due to one thing or it might have been due to another. It might have been due to the pressure of the gear on the flywheel or then again it might have been due to somthing else.

XQ. 1348. Will you spin this gear quickly on Exhibit 79, and——

A. (The witness complies.)

XQ. 1349. Give it a good hard spin. Push it hard.

A. (The witness complies.)

XQ. 1350. Now spin it the other way.

A. (The witness complies.)

XQ. 1351. Hard.

A. (The witness complies.) I notice that this gear is loose. That there is considerable end play, and it does not seem to me to indicate anything at all. If you will put a collar on it——

XQ. 1352. Spin the top gear. I referred to the wrong one.

Mr. Ward: You want it in mesh, don't you, before you spin it?

Mr. Ashton: Yes.

A. (The witness complies.)

XQ. 1353. What happened?

A. The lower gear moved out of engagement with the top gear.

XQ. 1354. What is that due to?

A. That is due to the direction in which the teeth are cut.

XQ. 1355. They are helical?

A. Yes. And the fact that the gear is not supported as it should be on the shaft.

XQ. 1356. Did you have any such action in your first demonstration of the Engl machine?

A. There may have been some slight action of that character. To my mind it was immaterial.

XQ. 1357. You just said it introduced some friction. I understood that you meant by that damping.

A. Oh, no. That is different. Those are two different things.

XQ. 1358. What was the difference?

A. There was a difference in the friction between the two conditions, which may have been due to a number of causes.

XQ. 1359. And you selected the spring which you used last night to go with the amount of friction which was left in the machine?

A. No, I did not select the spring at all.

XQ. 1360. Was it selected for that purpose?

A. I think there is a given relation between the spring and the amount of friction.

XQ. 1361. It was selected definitely for that purpose, wasn't it?

A. No, I don't think it was.

XQ. 1362. What was done?

A. A new spring was provided to take care of the different conditions in the machine.

XQ. 1363. A suitable spring or a lighter spring than the original?

A. I don't think there is very much difference, unless you can find the other spring. It is a shorter spring.

MR. WARD: Here is the other spring.

THE WITNESS: I think perhaps that the one used in the second test may be, to some degree, a lighter spring. More feeble.

RE-DIRECT EXAMINATION.

By MR. WARD:

RDQ. 1364. What bearing is the defendant using in its sound head machines? Cast iron bearings or roller bearings?

A. I understand the drawing on the PS16 machine shows a pair of ball bearings.

Mr. Ward: Your Honor, I don't know what these other books were that Mr. Ashton referred to, but I only call attention to the one from the American Machinist, that it is describing bearings for lathes, and so forth, I believe. Machine tools.

A. May I finish that answer?

RDQ. 1365. Yes.

A. I only referred to the PS16. I note on the diagram representing the PS1 apparatus that there is a ball bearing on the end of the shaft which carries the flywheel and sprocket.

RDQ. 1366. Was the grease in this Tri-Ergon machine used for lubricant?

A. Yes.

RDQ. 1367. And Mr. Ashton referred you to grease used in the defendants' machine. What is it used there for: grease of the character that he referred you to?

A. In this case it is definitely used as a viscous damping device for producing friction.

RDQ. 1368. Where is it used: on that pressure pad?

A. Yes, it is used on the pressure pad indicated in Figure 8 of Exhibit 16-C between N and the flywheel.

RDQ. 1369. And the pressure pad is the felt pad?

A. And a felt pad is placed between the member N and the flywheel.

RDQ. 1370. And that is under heavy pressure?

A. That is under considerable pressure. The pressure is placed on the member N by means of an adjustable screw and a coil spring.

RDQ. 1371. To produce damping?

A. To produce what the defendant calls damping.

MR. HASELTON: I offer in evidence title page and copy of article in the General Electric Review, Volume 31, No. 9, September 1928, entitled "Characteristics of Photoelectric tubes," by Dr. Koller and H. A. Breeding, and ask that the same be marked Plaintiffs' Exhibit 84.

(Received in evidence and marked Plaintiffs' Exhibit 84.)

MR. HASELTON: I offer in evidence Item 1735, entitled "Persistence of the Current in Photoelectric Cells after the Suppression of the Exciting Light," in Science Abstracts, 1915, Section A, published January 17th, 1916, this item being found at page 673.

(Received in evidence and marked Plaintiffs' Exhibit 85.)

MR. HASELTON: I offer in evidence article by Herbert E. Ives in Astro-Physical Journal of November 7th, 1917, found at pages 241 to 248, and ask that it be marked Plaintiffs' Exhibit 86.

(Received and marked Plaintiffs' Exhibit 86.)

MR. HASELTON: I offer in evidence File Wrapper and Contents of Hoxie Patent No. 1,758,794, previously marked for Identification as Exhibit 39, and now ask that it be marked Plaintiffs' Exhibit 39 in evidence.

(Received in evidence and marked Plaintiffs' Exhibit 39.)

MR. HASELTON: I offer in evidence File Wrapper and Contents of Heisler Patent No. 1,771,922, and ask that it be marked Plaintiffs' Exhibit 87.

(Received and marked Plaintiffs' Exhibit 87.)

MR. HASELTON: I offer in evidence File Wrapper and Contents of Heisler Patent No. 1,793,399, and ask that the same be marked Plaintiffs' Exhibit 88.

(Received and marked Plaintiffs' Exhibit 88.)

MR. WARD: I offer in evidence Tri-Ergon Sound and Picture Head, having film movement representing Figures 3, 4, 5 and 6 of the patent in suit and in the condition as demonstrated to the Court, the machine in this form being as shown in photographs of Plaintiffs' Exhibits 90-A and 90-B.

(Tri-Ergon sound and picture head, representing Figures 3, 4, 5 and 6 of patent in suit as demonstrated, received in evidence and marked Plaintiffs' Exhibit 89.)

MR. WARD: I offer in evidence the set of photographs of this machine as above described, and ask that the same be marked Plaintiffs' Exhibits 90-A and 90-B.

(Received and marked Plaintiffs' Exhibits 90-A and 90-B.)

MR. WARD: I offer in evidence a pair of new helical gears that the witness Ballard referred to put in the machine after the demonstration to the Court and as used during the demonstration last evening to defendants' representatives, and ask that the same be marked Plaintiffs' Exhibit 91.

(Received in evidence and marked Plaintiffs' Exhibit 91.)

MR. WARD: And I also offer in evidence the spring used in the machine between the flywheel and the arm in the said last demonstration with these new gears, and ask that the same be marked as Plaintiff's Exhibit 92.

MR. ASHTON: I object to the offer of the foregoing exhibits, being parts of the machine in the photographs, on the ground that it is not a representation of anything disclosed in the patent in suit.

(Received in evidence and marked Plaintiffs' Exhibit 92.)

MR. WARD: I offer in evidence sound and picture head of the second Tri-Ergon machine with film movement representing Figure 2 of the patent in suit, and ask that the same be marked Plaintiffs' Exhibit 93. This machine being shown in photographs Plaintiffs' Exhibits 29, 30, 31.

MR. ASHTON: I object to the machine on the ground that it does not represent anything in the patent in suit.

(Received and marked Plaintiffs' Exhibit 93.)

MR. WARD: I offer in evidence page 301 of the Transaction of the Society of Motion Picture Engineers, Volume XI, No. 30, of 1927, referred to by the witness Ballard, and ask that it be marked Plaintiffs' Exhibit 94.

(Received and marked Plaintiffs' Exhibit 94.)

IT IS STIPULATED AND AGREED THAT the first reel of film shown Professor Ballard was one of the reels used in defendants' demonstration in demonstrating the defendants' alleged infringing apparatus; that the second reel shown Professor Ballard was the reel which was used in the defendants' demonstration in demonstrating the defendants' model of the early German patent.

IT IS STIPULATED AND AGREED that the very small cylindrical record which was demonstrated on the Edison Triumph machine had on it speech and the waltz, and that both were demonstrated during defendants' demonstrations under Item 18-A on defendants' program. No other record than speech and the waltz were demonstrated under Item 18-A of defendants' program.

Subject to correction, if error should appear, the tune "Silver Threads Among the Gold," referred to in

Mr. Ashton's questions to Professor Ballard, was played as an accompaniment to a quartette. The quartette was not singing all the time during the tune. The accompaniment was continuing at the usual intervals when you could not hear any voices.

MR. ASHTON: IT IS STIPULATED AND AGREED that if witnesses were called on behalf of the defendant, they would testify that the General Electric Company, Radio Corporation of America, American Telephone & Telegraph Company and Western Electric Company, Inc., had general licensees under each other's United States patents during the period from 1920 until 1926, said licenses including, among other things: "All applications not herein otherwise specified of inventions pertaining or applicable to or to the use of vacuum tubes and to generating (directly or from other currents) modifying, amplifying, transmitting or receiving electromagnetic waves, variations or impulses for other than power purposes, including instruments and their records for producing music and other sounds for amusement or artistic purposes, with the right to transmit the sound by wire telephony, through a building."

That the said companies, beginning July 1st, 1926, and extending until the present time, have had specific licenses under each other's United States patents, in the sound picture field, this agreement mentioning specifically electrical sound recording, electrical phonographs, apparatus for co-ordination of sound and pictures.

That Bell Telephone Laboratories, Inc., is a wholly owned subsidiary of the American Telephone & Telegraph Company and Western Electric Company, Inc.

That the Electrical Research Products, Inc., is the wholly owned talking motion picture subsidiary of the Western Electric Company.

That the R. C. A. Photophone Company is a wholly owned talking picture subsidiary of the Radio Corporation of America.

That the said Electrical Research Products, Inc., and R. C. A. Photophone were sub-licensees respectively of the Western Electric Company, Inc., and Radio Corporation of America, in the sound picture field under the patents of the said General Electric Company, Radio Corporation, American Telephone & Telegraph Company, and Western Electric Company, since the formation of the said companies, Electrical Research Products, Inc., and R. C. A. Photophone. Electrical Research Products, Inc., was incorporated December 20, 1926, and that said license agreements do not list or mention any particular patents.

MR. ASHTON: I request that the reporter copy into the record as page 1613-A the list of references which were cited during the nullity decisions against the German Patent No. 417,967.

MR. WARD: This is objected to as irrelevant and immaterial, and having nothing to do with the issues in this case.

MR. ASHTON: I offer in evidence file history and contents of the Cawley Patent No. 1,710,677, granted April 23d, 1929, and ask that it be marked Defendants' Exhibit 157.

(Received and marked Defendants' Exhibit 157.)

MR. ASHTON: I offer in evidence File History and Contents of the Cawley Patent No. 1,825,440, and ask that it be marked Defendants' Exhibit 158.

(Received and marked Defendants' Exhibit 158.)

MR. ASHTON: I offer in evidence set of photographs taken by a photographer employed by the defendants of the Tri-Ergon machine, alleged to represent Figures 3, 4, 5 and 6 of the patent in suit, which photographs were taken on the Monday following the demonstration when the machine was represented to be in the same condition as when it was demonstrated to the Court by the plaintiffs, the said photographs to be marked Defendants' Exhibits 159-A, 159-B, 159-C, 159-D, 159-E, 159-F and 159-G.

(Received in evidence and marked Defendants' Exhibits 159-A to 159-G inclusive.)

Taking of Testimony Closed.

STIPULATION.

It is stipulated and agreed by and between counsel for the parties hereto that counsel may refer in briefs and argument in the Court of Appeals to any statements made by counsel for either party at the trial with respect to plaintiffs' motion for a list of anticipations, and defendants' motion to dismiss for misjoinder of parties-plaintiff, and the court's rulings thereon, and to statements in the record by counsel on any other matter, also to the original transcript of the testimony.

OPINION OF NOVEMBER 24, 1933.

See Memorandum of Corrections of Opinion, Printed Following This Opinion.

IN THE DISTRICT COURT OF THE UNITED STATES, IN AND FOR THE MIDDLE DISTRICT OF PENNSYLVANIA.

IN EQUITY, No. 971.

American Tri-Ergon Corporation, Tri-Ergon Holding, A. G.,

Plaintiffs,

v.

Altoona Publix Theatres, Inc.,

Defendants.

IN EQUITY, No. 972.

American Tri-Ergon Corporation, Tri-Ergon Holding, A. G.,

Plaintiffs,

v.

Wilmer & Vincent Corporation and Locust Street Real Estate Company,

Defendants.

Appearances:

MESSRS. KAUFMAN & MATTES, Scranton, Pennsylvania, attorneys for plaintiffs;

HUGH M. MORRIS, ESQ.; S. MORTIMER WARD, ESQ., PAGE S. HASELTON, ESQ., of counsel;

MESSRS. O'MALLEY, HILL, HARRIS & SARRIS, Scranton, Pennsylvania, attorneys for defendants;

CHARLES NEAVE, ESQ.; HENRY R. ASHTON, ESQ., J. HUFF, W. J. BARNES, ESQ., of counsel.

OPINION.

The bill of complaint charges the defendants with infringement of letters patent No. 1713726 relating to photographic sound on film recording and reproducing. The plaintiffs in each suit are American Tri-Ergon Corporation, assignee of the patent, and Tri-Ergon Holding, A. G., exclusive licensee for certain purposes. The nominal defendant in the first suit is the Altoona Publix Theatres, Inc., which leases and operates the machine about which complaint is made, known as "P. S.-16". The nominal defendants in the second suit are Wilmer & Vincent Corporation which operates the machine of which complaint is made, known as "P. S.-1" and the Locust Street Real Estate Company which leases the machine and owns the theater. In each suit the real defendant is R. C. A. Photophone, Inc. a wholly owned subsidiary of Radio Corporation of America which leases the machines and is defending in the suit.

Hans Vogt, Joseph Massolle and Josef Engl, three German inventors who had previously secured a patent in Germany for a sound picture machine, made application, as joint inventors, in the United States on March 20, 1922, for the patent in suit and on May 21, 1929, the patent in suit was issued to William Fox, assignee, from whom by mesme assignments the plaintiffs have become assignees and licensees of the patent in suit.

In their answer the defendants deny the validity of the patent in suit and also deny infringement. On the pleadings and evidence, two main questions arise for disposition; first, the validity of the patent in suit; and, secondly, its infringement by the defendants.

First, as to the validity of the patent: The patent in suit relates to phonographs or sound heads with

linear sound records, but more specifically to apparatus and methods whereby sound is translated by light to or from a photographic film strip. The specification and drawings describe and show apparatus and methods involving a film strip with a photographic sound record wherein the sound is translated by acoustically modulated light. The apparatus is especially useful for sound on film sound pictures. The apparatus is directed to a sound on film sound heads in an assembly designed for the production of sound on film sound pictures, since the sound track is arranged on the film alongside of the pictures and the apparatus is so organized that it may be placed above or below the picture projection head and have the film run from one to the other with the protecting loops in the film where it enters and leaves the sound head mechanism. The patent describes several features which co-operate to give high quality sound on film sound reproduction without appreciable sound distortion, in order to attain sound reproduction sufficiently realistic to accompany motion pictures, as follows:

First, means for momentarily giving the short active length of film in the sound head the property of a weighty mass in such manner as to obtain a high degree of uniformity of speed at the translation point; secondly, a focused fine line of light known as an "optical slit" for recording and reproducing; thirdly, bending the film arcuately at the translation point; fourthly, a photoelectric cell for reproducing the sound.

In each of the constructional forms shown in the patent, the film is either wrapped around a substantial portion of the flywheel roller under tension so as to avoid relative slippage one with respect to the other, or is passed over a substantial portion of a flywheel sprocket to insure meshing with a number of the teeth of the sprocket so that in both cases the protion of

the film engaging the member secured to the flywheel is definitely harnessed to it to prevent relative movement so that the film moves in exact conformity with the member secured to the flywheel and thus has given to it at the translation point, the property of a weighty mass. The flywheel with its film engaging sprocket or roller, is located on a shaft at or adjacent to the translation point and is either isolated by the spring drive from the irregularities of the driving mechanism, or is isolated from the driving mechanism by being driven by the film.

The plaintiffs' patent contains nineteen claims of which seven are in suit; claims 5, 7, 9, 13, 17, 18 and 19. These seven are directed and limited to the apparatus wherein or methods whereby sound is translated by light to or from a film strip; claims 9, 13, 18 and 19 as granted and claims 5, 7, and 17 by disclaimer. Claims 5, 7, 18 and 17 are apparatus claims and 9, 18 and 19 are method claims. These claims describe several featurs all co-operating to eliminate disturbances and distortions of the sound, giving reproductions sufficiently realistic to accompany motion pictures, a result never previously accomplished with sound on film sound pictures. The patent in suit discloses an apparatus and method which successfully establishes a new and important art, sound on film sound pictures.

The evidence shows that the patentees were the first to demonstrate by public exhibition sound on film or sound on film sound pictures in 1922 with one of their machines. Machines built in accordance with the claims of the patent have been demonstrated and used at various times and places down to the trial during which time they were successfully demonstrated in the hearing of the court.

The defendants contend that the patent is invalid for the following reasons:

First, because the patent is anticipated by the prior art, prior patents, inventions, publications and uses; secondly, because of a grant of at least one earlier foreign patent to the same patentees for the same alleged invention upon application filed in Germany more than twelve months prior to the filing in this country of the application for the patent in suit; thirdly, because the patent contains insufficient disclosures and is indefinite and inoperative; fourthly, because new matter was introduced into the application while pending in the patent office so that the patent as issued is for a different invention from that originally applied for; fifthly because the application was unlawfully expanded in the patent office to cover the practical art so developed in the meantime and gone into public use; sixthly, because the disclaimer filed within a few days before the trial is invalid, and, seventhly, because the alleged invention was not a joint invention of the three patentees.

First, as to the prior art. The combination and method of the claims at issue are not found in any prior art citations and are new and useful. Anticipation of such claims is not made out by selecting a part from one prior art citation and parts from others or by modification of prior art devices which were not designed, adapted or actually used for the purpose. Topliff vs. Topliff, 145 U. S. 156. None of the defendants' citations anticipates the claims at issue since none give in substance the same knowledge and the same directions as the specifications of the patent in suit. Skelly Oil v. Universal Oil, 31 F. (2d) 427. It must also be considered that patents which are inoperative or useless for the purpose of the patent in suit are not anticipations. Consolidated v. Window Glass Mch. 261 F. 362. Anticipations are not made out by the operation of prior devices with important or essential parts omitted.

Eck v. Kutz, 132 Fed. at 779. An unappreciated use does not anticipate. Tilghman v. Proctor, 102 U. S. at 711. Oral evidence by prior use or discovery must be clear and satisfactory. Eibel Process case, 261 U. S. 45.

In Richmond Screw Anchor Co. v. United States, 275 U. S. 331, 339, it was said: "It is argued on behalf of the United States, that Lenk's invention was unpatentable because it embodies nothing more than a natural and normal modification of existing ideas. Such modifications and their advantage were all very clear after the fact; . . No one else had foreseen its advantage. Lenke offered it as a solution of the problem at a minimum cost with a maximum efficienty, . . . While thus, in a way, he improved an existing idea, he developed a new idea."

In the case of Hobbs v. Beach, 180 U. S. 392, it is stated: "While none of the elements of the Beach patent—taken separately or perhaps even in a somewhat similar combination—was new, their adaptation to this new use and the minor changes required for that purpose resulted in the establishment of practically a new industry, and was a decided step in advance of any that had heretofore been made" . . .

"We agree with the courts below that it did involve inventions to see that a machine of the Dennis and York types was adaptable to the work of the Beach device, and second, to make such changes as were necessary to adapt that device to its new function."

The defense of invalidity on the ground of the prior art is not sustained.

Secondly, because of a grant of at least one earlier foreign patent to the same patentees for the same alleged invention upon application filed in Germany more than twelve months prior to the filing in this country of the application for the patent in suit.

The evidence shows that the original German patent was inoperative and that the invention claimed in the foreign patent is not the same invention as claimed in the patent in suit. Leeds & Catlin case, 213 U. S. 301. The defense of invalidity under R. S., Sec. 4887 puts a heavy burden on the defendants which they have not overcome. General Electric Co. v. Alexander, 280 F. 852.

The claim that the patent in suit is invalid under R. S. Sec. 4887 is not sustained.

Thirdly, because the patent contains insufficient disclosures and is indefinite and inoperative. The disclosures of the patent are sufficient. The fact that the patent in suit discloses apparatus and methods which enable successful establishment of sound on film sound pictures overcomes this contention.

Fourthly, because new matter was introduced into the application while pending in the patent office so that the patent as issued is for a different invention from that originally applied for.

Fifthly, because the application was unlawfully expanded in the patent office to cover the practical art so developed in the meantime and gone into public use.

The answers to the fourth and fifth claims of invalidity are the same here. The amendments to the claims while pending were related to the original claims and were applicable to the invention and were disclosed in the original drawings and specifications. The patentees were entitled to secure in the patent in suit their actual invention as disclosed in the original drawings and specifications, and were entitled to amend their claims while their application was pending. Heller Bros. v. Crucible Steel, 297 F. 39.

The amendments were properly allowed and the claim of invalidity on the ground of the amendments cannot be sustained.

Sixthly, because the disclaimer filed within a few days before the trial is invalid. The disclaimer limits the patent and does not enlarge it. The subject matter of the disclaimer is consistent and in accordance with the teachings of the patent. No part of the disclaimer broadens or purports to broaden the scope of the claim of the patent. The presumption of validity of the patent in suit is uneffected by the disclaimer and the claims in suit here, as modified by the disclaimer, are valid. Carnegie Steel case, 185 U. S. at 435.

Seventhly, because the alleged invention was not a joint invention of the three patentees. The evidence shows that the patentees worked together and jointly on this invention that the patent in suit is a joint invention of the three patentees within the meaning of the statute, and the burden of proof rests on the defendants to show that the patent in suit was not a joint invention of the three patentees. Thropp v. DeLaski, 226 F. 949; Hal, Signal v. Union, 115 F. 638.

The claim of invalidity on the ground that the patent is not a joint patent cannot be sustained.

As bearing on all of these claims of invalidity, it must be borne in mind that the grant of a patent carries with it the presumption of validity.

"The authorities hold that, to overcome this presumption, the burden of proving want of novelty rests upon him who asserts it, and every reasonable doubt should be resolved against him. The evidence must be exceptionally clear and convincing; as many authorities have said, it must be full unequivocal and convincing. Coffin v. Ogden, 18 Wall, 120." Window Glass Mach. Co. v. Smethport Window Glass Co. 266 F. 85, at page 93.

Under the evidence and legal authorities, all of the defendants' claims of invalidity of plaintiffs' patent are overruled and the patent in suit is sustained as valid.

Secondly, as to the infringement. The plaintiffs charge that six of the claims, 5, 7, 9, 13, 18 and 19 are infringed by defendants' machine "P. S.-1" and that five of the claims, 9, 13, 17, 18 and 19 are infringed by defendants machine "P. S.-16". Defendants' machine "P. S.-1" embodies the invention of claims 5, 7, 9, 13, and 18 and defendants' machine "P. S.-16" embodies the invention of claims 9, 13, 17, 18, and 19. Claims 5, 7, 9, 13, 18 and 19 were applied by plaintiffs' expert witness, Ballard, element by element, to defendants' "P. S.-1" machine and the same witness applied claims 9, 13, 17, 18 and 19, element by element, to defendants' "P. S.-16" machine and all of the evidence in the case show that these two machines of defendants infringe plaintiffs' patent in suit.

The plaintiffs and defendants have submitted proposed findings of fact and conclusions of law which have been answered and are filed herewith.

In conclusion the court finds that the plaintiffs' patent No. 1713726 is valid and that claims 5, 7, 9, 13, 18 and 19 of the patent are infringed by defendants' "P. S.-1" machine and that claims 9, 13, 17, 18 and 19 of the patent are infringed by defendants' machine "P. S.-16". It follows that plaintiffs are entitled to the usual decree for an injunction reference, accounting and costs in accordance with this opinion; and it is so ordered.

ALBERT W. JOHNSON,
United States District Judge.

November 24, 1933.

MEMORANDUM OF CORRECTIONS OF OPINION DATED NOVEMBER 24, 1933.

Page 2, first paragraph, second line, now reads: "inventors who had previously secured *a patent* in Germany" should read—"inventors who had previously secured *patents* in Germany."

Page 2, first paragraph, last two lines, now read —"assignee, from whom by mesne assignments the plaintiffs have become assignees and licensees of the patent in suit." Should read—"assignee, from whom the plaintiff, American Tri-Ergon Corporation has become assignee of the patent in suit."

Page 4, first paragraph, line sixth, now reading— "Claims 5, 7, *18* and 17" should read—"Claims 5, 7, *13* and 17 . . ."

Page 5, next to the last line, now reads "Oral evidence *by* prior use . . . " should read: "Oral evidence *of* prior use . . . "

Last page, second paragraph, sixth line, now reads: "Invention of claims 5, 7, 9, 13 and 18 . . . " should read—"invention of claims 5, 7, 9, 13, 18 and 19."

ALBERT W. JOHNSON,
United States District Judge.

December 15, 1933.

PLAINTIFFS' PROPOSED FINDINGS OF FACT.

1. Broadly speaking, the patent in suit relates to phonographs or sound heads with linear sound records, but more specifically to apparatus and methods whereby sound is translated by light to or from a photographic film strip. The specification and drawings describe and show *no other* apparatus or method than those involving a film strip with a photographic sound record, i. e., wherein the sound is translated by acoustically modulated light. (See all pat. dwgs. more clearly in Figs. 3 and 6; and specification throughout, for example, p. 1, line 91; p. 2, line 1; lines 41-50; lines 112-114; 126; p. 3, line 17; Ballard, Tr., 508.) Affirmed

2. The character of light by which the sound is translated to or from the film is described as a narrow line of light focused on the film, and it is shown in the drawings as focused to a very fine line. (Pat., p. 2, lines 42-45; p. 3, lines 33-42. See drawings, and Ballard, Tr., 520; 880, XQ418.) Affirmed

3. The film strip is shown in the drawings (more clearly in Figs. 3 and 6) as a perforated film strip with the sound record on the margin and with the portion between the sprocket holes left for the pictures, but the specification also states that the sound record may be located on the film between the two rows of sprocket holes. (Pat., p. 3, lines 49-54.) Affirmed

4. The apparatus is especially useful for sound on film sound pictures. The claims in suit are not limited to the use of the apparatus for sound pictures but the apparatus is directed to a sound on film sound head in an organization especially designed with a view to the production of sound on film sound pictures, since the sound track is arranged on the film alongside Affirmed

of the pictures and the apparatus is so organized that it may be placed above or below the picture projection head and have the film run from one to the other with the protecting loops in the film where it enters and leaves the sound head mechanism. (Ballard, Tr., 511; pat., p. 2, lines 105-9; line 125 to p. 3, line 12.)

Affirmed

5. The patent describes several features which co-operate to give high quality sound on film sound reproduction, i. e., without appreciable sound distortion, in order to attain sound reproduction sufficiently realistic to accompany motion pictures. These features are:

(1) Means for momentarily giving the short active length of film in the sound head the property of a weighty mass in such manner as to obtain a high degree of uniformity of speed at the translation point.

(2) Utilizing a focused fine line of light, now known as an "optical slit", for recording and reproducing (instead of a mechanical slit directly against the traveling film, thus avoiding accumulation of dirt at this point which resulted in obstructions to the light at the mechanical slit and the scratching of the sound records).

(3) Arcuately bending the film at the translation point (this prevents certain difficulties, including elimination of irregular depressions at sprocket holes and the natural transverse curling of such film, which would throw the fine line sound track out of the focal plane of the line of light and thus distort the sound); and

(4) The use of a photoelectric cell for reproducing the sound (this gives instantaneous and true proportional response of the cell to the action

of the line of light thereon to prevent distortion of the sound). (See pat. and references supporting findings 7, 8, 9, and 10 on each of the four points.)

6. Each of said four features of Finding 5 is also disclosed in the original application as filed. (See original application Pltf.s' Ex. 1; and same references as supporting findings 7, 8, 9 and 10.) Affirmed

7. In each of the constructional forms shown in the patent, the film is either wrapped around a substantial portion of the flywheel roller under tension so as to avoid relative slippage one with respect to the other, or is passed over a substantial portion of a flywheel sprocket to insure meshing with a number of the teeth of the sprocket so that in both cases the portion of the film engaging the member secured to the flywheel, is definitely harnessed to it to prevent relative movement so that the film moves in exact conformity with the member secured to the flywheel and thus has given to it at the translation point, the property of a weighty mass. (See all the pat. dwgs. and description in specification; also explained plaintiffs' main brief, mid., pp. 8-10.) Affirmed

8. The focusing of the light to a fine transverse line upon the film at the translation point, as distinguished from using a small mechanical slit against the film, is known as an "optical slit" and is shown in the drawings and described in the specification. The line of light source which is focused is disclosed in the patentees' patent No. 1,590,185 (Pltf.s' Ex. 7) referred to in the specification of the patent in suit at page 3, line 45. (See same references as to finding 2; and Ballard, Tr., 519-27; 1686; 879, XQ417; explained plaintiffs' main brief, pp. 11-13 and reply brief, pp. 9-10). Affirmed

Affirmed

9. The film is shown bent arcuately longitudinally at the translation point in the constructions of Figs. 2 and 3-4, by being wrapped around a portion of the roller or sprocket at the translation point. (See also plaintiffs' main brief, pp. 13-14 with citations, Tr., 535-42; 1746-7; 545-6.)

Affirmed

10. A photoelectric cell is shown as the light sensitive element at the translation point in each of the three forms of apparatus of the patent, being located in Fig. 1 in the cylindrical casing *h* and in the other forms being located at the axis of the film sprocket or roller. (Ballard, Tr., 527-31; Waterman, Tr., 1423, XQ242; Tr., 1424, XQs246-48; explained plaintiffs' main brief, pp. 14-15 and reply brief, p. 14.)

Affirmed

11. Suitable circuits for the photoelectric cell were disclosed in the patentees' pending earlier application (Pltf.s' Ex. 8, filed in the United States, April 4, 1921, under the Nolan Act, with effective date of its corresponding German application of March 3, 1919, Pltf.s' Ex. 9; also Judge Adkins' Findings of Fact Nos. 4-15; 33-4, Pltf.s' Ex. 10).

Affirmed

12. The patent shows and describes three constructional examples of the invention: One in Fig. 1; another in Fig. 2, and the third in Figs. 3 to 6. In each a flywheel is connected directly with a film-engaging sprocket or smooth roller, as the case may be, the sprocket or roller being either at or adjacent to the translation point. (Also see same references as to finding 7.)

Affirmed

13. In the construction of Fig. 1 the translation point is between a film-engaging smooth roller *r*1 and a film-engaging sprocket *r*2, over a substantial portion of each of which the film engages and each of which

has a flywheel on its shaft; but the specification teaches that either of the flywheels may be omitted (p. 1, line 96). In either case the translation point is located adjacent the flywheel roller *r*1 or the flywheel sprocket *r*2. If the flywheel is omitted from the sprocket *r*2 then the construction is one where the flywheel speed control is due to the film passing over a substantial portion of the smooth roller *r'* around which the film is wrapped and held into engagement under tension and to which the flywheel is secured. If the flywheel is omitted from the shaft of the smooth roller *r'* then that roller acts as a guide and feeding means for passing the film from the sprocket *r*2 past the translation point and back to the sprocket so as to hold the film in position against the member *h* at the translation point; and the flywheel control results from the flywheel on the shaft of the sprocket *r*2. The film is guided to and from, and pressed upon the sprocket by pressure rollers *dr*1, *dr*2. (See patent.)

14. In Fig. 2 construction the film is fed by a sprocket V over a substantial portion of a smooth roller R to which is rigidly secured the flywheel *m*, and thence passes over a portion of the sprocket V2 which feeds it from the roller R. Spring-pressed means in the form of small rollers are provided to cause the film to tightly hug, under tension, the portion of the roller R over which it is wrapped. (See patent.) Affirmed

15. In the constructions of Figs. 3 to 6, inclusive, the film is fed over a substantial portion of a sprocket against which it is firmly pressed by rollers *e*, *g*. The flywheel is here again secured to the shaft of the sprocket. (See patent.) Affirmed

16. The specification teaches that the flywheel may be driven by a spring which can be very feeble as, at Affirmed

constant speed, it has to overcome only losses from the friction of the driven parts (that is, the friction of the sprocket-flywheel assembly and the active portion of the film in the sound head); and that stops are provided to limit the play of the spring in the starting and stopping of the mechanism. This spring drive is proposed for use where the flywheel and its connected sprocket are to drive the film as in the construction of all of the figures but Fig. 2 where the flywheel-roller assembly is driven by the film and hence does not need this spring connection to isolate the assembly from the irregularities of the driving mechanism (pat., p. 1, lines 82-6; p. 3, lines 75-85; Engl, Tr., 355-6; 413-14; Ballard, 888).

Affirmed

17. The flywheel with its film engaging sprocket or roller, is located on a shaft at or adjacent to the translation point, and in the preferred forms it is either isolated by the spring drive from the irregularities of the driving mechanism, or is isolated from the driving mechanism by being driven by the film. It is known as a "filter flywheel" (Engl and Ballard, Tr., 1692-3).

Affirmed

18. The embodiments of the invention shown and described in the patent are operative and useful.

([a] as to the construction of Fig. 1, see Engl, Tr., 219-27; Pltf.s' Ex. 2nd Tri-Ergon mach. 19a; Tr., 235; 399, and plaintiffs' main brief, p. 16; and reply brief, p. 12.

[b] as to the construction of Fig. 2, see Tri-Ergon mach. Pltf.s' Ex. 93, demonstrated to Court with performance beyond criticism by defendants; photos Pltf.s' Exs. 29-31; Tr., 1543-6; 1658-9; as to its construction see also Tr., 472-75; 477; also Tr., 916-18 and Deft.s' Ex. 130 [magazine article]—re use by "Tobis."

[c] as to the construction of Figs. 3 to 6, see Tri-Ergon mach. Pltf.s' Ex. 89, demonstrated to the Court with performance beyond criticism by defendants' photos Pltf.s' Exs. 90A, 90B; Tr., 1535-46; 1656-58; 1794-97; 1809; also Pltf.s' Ex. 17; Tr., 229-31; 280-82; 236-38; 162-93; Pltf.s' Exs. 27a and 27b; Tr., 243-49; 238-40; 251; 430-34; Pltf.s' Exs. 23 and 24; Tr., 447-53; explained plaintiffs' main brief, bottom pp. 16-19 and 36-37.)

19. The patentees demonstrated one of their machines substantially according to Fig. 1 of the patent, to outsiders in the spring of 1921; and one according to Figs. 3 to 6 of the patent later in 1921 with sound pictures; successfully commercially used one in 1922 in theatres in Berlin and others in Germany and Switzerland; in 1924-5 built others like Figs. 3 to 6 and used them commercially and their licensee used them thereafter, and built others like Fig. 2 of the patent in 1928-9. (See Engl's and Holborn's testimony and certain exhibits included in citations in support of Finding 18, and cited and explained in plaintiffs' main brief, pp. 17-19.) Affirmed

20. A machine according to Fig. 2 of the patent and a machine according to Figs. 3 to 6 of the patent were demonstrated to the Court with tone test records covering a wide range of tone frequencies; with a piano record of long sustained notes (used for testing such machines), as well as with speech and other music records, and the sound reproduction was very good; not even criticized by defendants. (See Tri-Ergon mach. Pltf.s' Ex. 93, demonstrated to the Court; photos Pltf.s' Exs. 29-31; Tr., 1543-6; 1658-9; see Tri-Ergon mach. Pltf.s' Ex. 89, demonstrated to the Court; photos Pltf.s' Exs. 90A, 90B; Tr., 1535-46; 1656-58). Affirmed

Affirmed

21. Defendants' model (Deft.s' Ex. 79, Photo Exs. 79A, B, C) alleged to represent Figs. 3 to 6 of the patent, and built and operated to show that this form of machine was inoperative or commercially useless, was improperly constructed so as to distort the sound, and was not a fair representation of the construction and operation of the machine of Figs. 3 to 6 of the patent. (See Tr., 1479-81; 1684-85; 1482-83; 1687-88; explained plaintiffs' main brief, pp. 37-39.)

Affirmed

22. The successful operation of plaintiffs' machine according to said Figs. 3 to 6 of the patent, without the added "shoe" which defendants contended had to be used, and without the special damping means alleged by defendants to be necessary, showed that said machine operated entirely satisfactorily without these features, and defendants introduced no evidence in support of their criticism, by argument, of the demonstration of plaintiffs' machine as given to the Court, or of the demonstration which the record shows was given to defendants after the demonstration to the Court. It appears from the record that after the demonstration to the Court, one or more of defendants' representatives informally criticized the machine in his or their talk with plaintiffs' representatives on the ground that certain driving gears were cut in a way that might create certain friction between two of the parts, but did not criticize the machine because its bearings were lubricated with grease; that, after this criticism, plaintiffs without admitting the merits of the criticism, but to avoid controversy, changed the cut of the gears to avoid the criticized point, and gave a second demonstration to defendants, and that defendants now criticize the machine, in argument only, on another ground, namely, that grease was used to lubricate the bearings; but they have produced no evidence in support of either point, nor as to the successful use of

the machine without the "shoe." Plaintiffs had a right to lubricate the bearings of their machine with grease. If the alleged inoperativeness of this embodiment of the invention is cured by such lubrication, there is no substance to defendants' contention of inoperativeness. (Tr., 1535-46; 1656-58; 1794-97; 1809; 1820; explained in plaintiffs' main brief, pp. 35-37; reply brief, p. 72.)

23. The disclosure or teachings of the specification and drawings of the patent are sufficient. (Engl, Tr., 436; Waterman, Tr., 1308; Engl, Tr., 355-56; 413-14; Ballard, 890; 905; Waterman, 1146; 1349; Ballard, 1688 and pertinent citations as to Finding 22; explained plaintiffs' brief, pp. 32-34.) Affirmed

23a. The patent in suit discloses apparatus and methods which enabled the successful establishment of a new and important art—sound on film sound pictures. (See citations for findings, 18, 19 and 20.) Affirmed

24. Sound on film sound pictures are preferable to sound on disk sound pictures (the former avoids the difficulties of synchronizing the disk and the picture film; also the danger of using a wrong disk record with the picture record, and avoids editing difficulties where it is necessary to delete or change certain parts of the picture film which requires corresponding changes in the sound disk record). Sound on film sound pictures have driven sound on disk pictures from the market (defendants' witness Hammon, Tr., 728; Joy, top, Tr., 461; and explained in Tr. of argument, p. 12). Affirmed

25. As far as this record shows the patentees were the first in the world to demonstrate by public exhibitions, either sound on film or sound on film sound pictures, which they did in 1922 with one of their machines according to Figs. 3-6 of the patent (Tr., 202-3; 236-8; 600). Affirmed

Affirmed

26. Defendants have not proved that a single sound on *film* machine was ever used outside of a private laboratory even without accompanying pictures, prior to the patentees' first public demonstration in 1922, of sound on film sound pictures, and such laboratory devices were not with accompanying pictures. (See ref.'s re findings 25, 27.)

Affirmed

27. As to these laboratory uses (Ruhmer, Story and Hoxie) the first two were but crude efforts which were abandoned. Hoxie's first machine, even if it could be held to be earlier than the patentees' date of March 24, 1921, admittedly did not give uniformity of speed and was unsatisfactory; and even if it could be held that the alleged use of a flywheel on the film sprocket shaft in that machine had been proven, it was admittedly promptly abandoned for the use of a ball governor speed control device. (As to Ruhmer, Tr., 202-3. As to Story see plaintiffs' main brief, pp. 109-11, explaining his testimony at 1010; 1040; 1011-12; 1039-41; 1050; 1046-7; 1051; 1013-14. As to Hoxie see citations as to findings 43, 44 and 48, infra.)

Affirmed

28. Defendants have not proved that a single sound on film machine or sound on film sound picture machine was ever put out prior to this trial utilizing a *stylus* for recording or reproducing the sound on *film*.

Affirmed

29. R. C. A.'s subsidiary—R. C. A. Photophone, Inc.—through whom it puts out its sound picture machines, was not incorporated until September, 1927, and so far as shown on this record, the first sound on film machine it put out was on October 28th, 1928 (a PS1 machine) and the first PS16 machine was on December 22d, 1929 (Tr., 1633; 1636).

Affirmed

30. Early in 1931 after plaintiffs threatened suit against R. C. A., the latter offered to take a license

under the patent if one could be secured upon reasonable terms. (See Pltf.s' Ex. 13, letters of January 31, 1931, and February 26, 1931; see plaintiffs' main brief, pp. 21-22.)

31. That on this record, as late as August, 1926, the only sound picture machine being publicly demonstrated in this country was a sound on *disk* machine put out by Western Electric Co. in a Warner Bros.' theater in New York City; that the witness Joy, after being given demonstrations of the Tri-Ergon machine in Berlin in 1926, advised William Fox to take an option on the American patents of the Tri-Ergon Co.; that pursuant to this option, Dr. Engl brought one of this Tri-Ergon sound on film sound picture machines over here in December, 1926, which was demonstrated with films recorded in Germany and with films recorded over here; that at that time the Fox-Case Co. had already signed a license with Western Electric, who were using *disk* records for the sound; that in view of this relationship between Fox-Case and Western Electric, the latter was given full access to the Tri-Ergon machine and demonstrations thereof, and Engl's services were made available in discussing the entire problems involved; that Fox exercised his option for the Tri-Ergon American patents, and Western Electric started in to experiment with and test out sound on film sound picture machines at the Fox studios for several months; that the first sound on film sound picture installation made by Western Electric was in July, 1927, at the Roxy Theatre, about seven months after Engl's machine arrived here; and nineteen others by October of that year; that as late as May, 1927, at the meeting of the Soc. of M. P. Engineers, the only apparatus exhibited there by Western Electric was sound on *disk* sound picture apparatus. (Engl. Tr., 257-8; 281-2; Joy, 444-66; 486-7; 491, Affirmed

XQ188; explained plaintiffs' main brief, pp. 19-21, and reply brief, bottom, pp. 94 and 95.)

Affirmed

32. As to the seven claims in suit, they are each directed and limited to an apparatus wherein or methods whereby sound is translated by light to or from a film strip (9, 13, 18 and 19 as granted, and claims 5, 7 and 17 by disclaimer). Claims 5, 7, 13 and 17 are apparatus claims and each is for a combination of two or more of the features set forth in Finding No. 5, supra. The remaining claims, 9, 18 and 19, are method claims and each is for a method including two or more of said features. The claims are not merely for the use of a flywheel in a sound head. (See claims with disclaimer, plaintiffs' main brief, pp. 163-66.)

Affirmed

33. Claim 7, which involves the spring drive, does not purport to claim broadly a spring drive between any driving and driven parts, or to claim a spring drive between a gramophone cylinder and its driving gear, but it is for a particular combination in a sound on film sound head in which the spring drive is included as one of the elements, with the flywheel, to produce, in combination with the others, a useful and valuable result. (See claim.)

Affirmed

34. Claim 13, which includes the photoelectric cell, does not purport to claim broadly the use of a photoelectric cell for reproducing sound, but it is a claim for a particular combination in a sound on film sound head in which the photoelectric cell is included as one of several elements, to produce in combination with the others, a useful and valuable result. (See claim.)

Affirmed

35. Defendants' PS1 machine embodies the invention of claims 5, 7, 9, 13, 18 and 19 as charged. (See claims as qualified by disclaimer, plaintiffs' main brief,

163-166. Ballard explains this machine Tr., 546-56, in connection with charts, Pltf.s' Exs. 16A, B and C; see also actual machine Deft.s' Ex. 76; see plaintiffs' main brief, pp. 23-24; bottom, p. 27. The claims were applied by Ballard element by element, to said machine; see Tr., 573-85. Defendants produced no testimony contradicting or questioning Ballard's testimony on this point, nor showed any differences in the construction or functioning of the machine which would differentiate it from the invention of said claims. There seems to be no dispute on the record that if the patent is valid these claims are infringed.)

36. Defendants' PS16 machine embodies the invention of claims 9, 13, 17, 18 and 19 as charged. (See claims as qualified by disclaimer, plaintiffs' main brief, 163-166. Ballard explains this machine, Tr. 585-92, in connection with charts, Pltf.s' Exs. 16D, E and F; also actual machine, Deft.s' Ex. 77; see plaintiffs' main brief, pp. 24-26; bottom, p. 27. The claims applied by Ballard element by element, to said machine; see Tr., 592-600. Defendants produced no testimony contradicting or questioning Ballard's testimony on this point, or showed any differences in the construction or functioning of the machine which would differentiate it from the invention of said claims. There seems to be no dispute on the record that if the patent is valid these claims are infringed.) Affirmed

37. Motion picture machines are different in construction and function from sound heads and involve different problems. Flywheels used in connection with the intermittent rotating sprocket of motion picture machines do not perform the same function as in the patent in suit, and in defendants' sound heads. Uniformity of speed of the film in motion picture projectors is not important even if it was not an intermittent Affirmed

motion. The flywheel is not on the film sprocket but on a shaft geared to it through intermittent gearing. The purpose of the flywheel is to carry this intermittent motion gear over the dead center and prevent its being locked at that point so as to avoid irregular strains on the *driving* mechanism by avoiding a jerky motion and heavy strains which the intermittent motion would cause on the driving mechanism if the flywheel were absent. The film motion remains an intermittent one and not one of constant or uniform speed. (Engl, Tr., 337-40; 406-8; Kindlemann, 632-4; Ballard, Tr., 555; 607; 1696-8; 1732; Q774; 1733, Q778; Tr., 929. Explained plaintiffs' main brief, pp. 46-48; reply brief, p. 61.)

Affirmed

38. A flywheel in a continuous movement motion picture machine is also for a different purpose than that of the patent in suit and of defendants' machine, i. e., it is to prevent strains on the *driving* mechanism. Uniformity of speed is not important in such a machine as the eye cannot detect substantial variations in the speed. (Ballard, Tr., 1731-34; 607; Engl, Tr., 339, XQ486; Tr., 340, XQ488; G. E. Co.'s Hoxie and Heisler pats., Pltf.s' Exs. 39, 49; plaintiffs' brief, pp. 47-8.)

Affirmed

39. Centrifugally actuated speed governors such for example as flyball governors, do not act like flywheels and they produce no appreciable flywheel effect. "A flywheel is a device the inertia of which is constant". The governors have a relatively low, variable inertia and because of this they may introduce oscillations; they did in the two Hoxie machines Defendants' Exhibits 43 and 45, and the results were not satisfactory. "The more rapid the speed fluctuations the more effective the flywheel will be and the less effective will a flyball governor be." Neither plaintiffs nor defendants use the ball governor in the sound head. (Engl,

Tr., 365-7; 410; Kindlemann, Tr., 641; Steiner, Tr., 1101, Q81; Tr., 1118; Ballard, Tr., 1786-8; explained plaintiffs' main brief, p. 45.)

40. Defendants contend that Hoxie operated his first laboratory sound on film machine with flywheel speed control to make a sound record (Deft.s' Ex. 51) as early as March 8, 1921. This date is only sixteen days ahead of the patentees' effective date of March 24, 1921 (disregarding the Vogt, et al. date of February, 1921 in finding 41 and the Berlin Treaty, as affecting Vogt, et al. German application of May 23, 1920 for German patent 387,058). The actual constructural features of this Hoxie first machine as to its embodying a flywheel on the film sprocket for speed control and certain other features, rests upon the oral testimony of Hoxie and two mechanics as to their recollection over a period of more than twelve years. They have not been identified with the subject matter for several years and their memory is shown to be unreliable or poor. No notebooks or records with respect to the construction or operation of this first machine were produced. The only alleged part of the original machine presented is the box (now a part of a different machine, Deft.s' Ex. 43) with a part of the film track or means for guiding the film. The alleged film sprocket and flywheel are not there. It is admitted that the machine was reconstructed in July or August, 1921, and oral testimony is relied upon to show that it embodied flywheel speed control when the sound record is alleged to have been made on it, March 8, 1921. The sound record itself does not prove the construction of the machine upon which it was made. Affirmed

When the dates are so close and the elapsed time so short such oral testimony is insufficient to establish the completion and the construction of said machine prior to March 24, 1921. (Hoxie, Tr., 1251; 1262-3;

1267; Steiner, Tr., 1088, Q17; 1100; 1108; 1110; Tschopp, Tr., 1183-4, Qs5, 11 and 1194, XQ80, XQ83; explained plaintiffs' main brief, 112-19 and reply brief, p. 58; argument, Tr., pp. 31-43.)

Affirmed

41. Engl testified with respect to one of the Tri-Ergon laboratory notebooks with entries, sketches and film records therein, that the patentees were experimenting with apparatus for recording sound on film prior to February, 1921, and that by February 10th they had built and were using a machine for recording tone frequencies on film, such machine being substantially along the lines of Fig. 1 of the patent in suit. Diagrammatic sketches of the apparatus and dated pieces of the original records appear in the notebook and are here in evidence (Engl, Tr., 222-7; 1811-13, Pltf.s' Ex. 79, etc.). I cannot accept the testimony to establish Hoxie's date as prior to March 24, 1921, without accepting the above testimony of Engl establishing the patentees' date as prior to Hoxie's alleged date of March 8th, 1921.

Affirmed

42. The Hoxie sound record, Exhibit 51, has at one end of it as a part of the sound recording, the date of March 8, 1921, but the film shows that it has two splices in it near this end. The film also has a date of March 9, 1921 printed on it in ink but the party who is said to have printed that date on the film was not called nor was his failure to testify explained. (See film, Deft.s' Ex. 51; Ballard, Tr., 1462; Hoxie, Tr., 1226; 1234; explained bottom main brief, p. 114 and Tr. of argument, pp. 45-6.)

Affirmed

43. According to defendants' witnesses, the first Hoxie machine is said to have been built with a flywheel and handle, to serve as a hand crank for the machine, but they could not get "any even speed" with

the machine; that it was then changed to a motor drive flywheel but this did not give satisfactory results so the machine was further changed by removing the flywheel and substituting a "gear and ball governor" which it is said was better than the flywheel, but that this also did not give satisfactory results, as the governor was "forever unbalanced" and introduced vibrations. This first machine, therefore, did not give satisfactory speed control in any of its alleged forms, and if it ever had a flywheel for the purpose of speed control it was a failure and was promptly abandoned for the said gear and ball governor control. (Steiner, Tr., 1105-7; Tschopp, 1191, XQs57-8; Steiner, 1108-9; 1100, Q74; 1108, XQ128; 1101, Q81; 1096, Q57; 1118, XQ194; explained plaintiffs' main brief, pp. 115-19; reply brief, p. 58; Tr. of argument, pp. 31-44.)

44. The speed of this first Hoxie machine when it embodied the gear and flyball governor, was not regulated or controlled by flywheel effect but the ball-governor brake was the controlling effect, the alleged flywheel—a gear (used with the ball governor)—being totally insignificant in the speed control; and was prevented by the governor-actuated brake from exercising even that insignificant effect. (Steiner, Tr., 1119, XQ202; Ballard, Tr., 1788-92; explained plaintiffs' main brief, pp. 118-19; 122-3.) Affirmed

45. Defendants' testimony is to the effect that the gear and ball governor finally put on the Hoxie first machine was the same as that now on the Hoxie second machine except that a flyball governor was used instead of the disk governor now on the second machine. The gear on this second machine is made from thin brass stock of approximately 5/16 of an inch thick with the central part turned down to about ⅛ of an inch (removing this weight) leaving it with just about enough Affirmed

strength to support and drive the gear and pulley at the periphery of it. Such construction negatives any idea of the intended use of this gear as a flywheel and its momentum effect on the speed is in fact insignificant. (Tr., 1101; 1210; Ballard, 1788-92; explained plaintiffs' main brief, pp. 118-119; 122-23; argument, Tr., pp. 36-7.)

Affirmed

46. That if the Hoxie first machine ever embodied the feature of flywheel speed control before the gear and ball governor were put on, it was a temporary and unappreciated use since the flywheel is said to have been put in the machine for other reasons, i. e., because it was easier to take a flywheel and put a handle on it than to make a crank handle which the witness Steiner was instructed to put on the machine and also because the flywheel he had available already had a pulley secured to it for driving the takeup reel of the machine. (Tr., 1105, XQ108; 1106, XQs110-11; explained plaintiffs' main brief, pp. 115-16; argument, Tr., pp. 32-36.)

Affirmed

47. That even as to the insignificant flywheel effect of the thin brass gear finally used on the first machine and used in the second machine, it appears from defendants' testimony that this brass wheel was not put on with any idea of flywheel effect but to support the gear and pulley carried at its rim. (Steiner, Tr., 1114, XQs166-170; explained plaintiffs' main brief, pp. 120-121; argument, Tr., 37-8.)

Affirmed

48. As to the second Hoxie machine, defendants' witnesses contend that it was completed in its first form as early as the middle of April, 1921, but they admit that due to its unsatisfactory operation a new governor was substituted for the ball governor in July or August, 1921. These dates are all later than the effective date of the patent in suit. The first construction of this

machine alleged to be as of April, 1921, was admittedly unsatisfactory, and as to both constructions, the speed control was by governor brake action and not by flywheel effect. (Tr., 1108, XQ128; 1101, Q81; 1096, Q57; 1118, XQ194; and citations of Finding 43.)

49. According to the testimony of defendants' witnesses as to Hoxie's first machine, and as shown by the construction of the Hoxie second machine, Defendants' Exhibit 45, the film was pulled by the film sprocket directly from the delivery reel over a guide roller past the translation point, and without any intervening loop, and the film was pulled from the film sprocket to the rewind reel without a loop. Such a construction produces a jerky motion on the film which will prevent uniformity of speed at the translation point. (Waterman, Tr., 1360-61; 1432; Ballard, 1717; 1700; 1706-7 and at other places in the record.) Affirmed

50. The Hoxie sound record, Defendants' Exhibit 51, was merely a speech record and not of a character to demonstrate speed control, but even so and by whatever machine it was recorded it was poor and showed evidence of having been stopped and started during the recording. Hoxie testified that he also made music records and he believed that the General Electric Co. had them, but none was produced for test. (Ballard, Tr., 1462; 1661; Hoxie, Tr., 1254-5.) Affirmed

51. In view of the foregoing findings Nos. 40 and 42 to 49, Hoxie cannot be accepted as a prior inventor to the patentees of even such features of his machine as defendants' witnesses allege were embodied in his machine. Affirmed

52. Neither Hoxie's first or second machines were ever used except experimentally in the General Electric Affirmed

Company's laboratory and the company has never put out any commercial reproducer for sound on film. (Hoxie, Tr., 1261; 1264.)

Affirmed

53. According to the testimony of defendants' witnesses as to the first Hoxie machine and as shown by the construction of the Hoxie second machine, Defendants' Exhibit 45, neither machine embodied any of the following features of the patent in suit—the arcuate bending of the film at the translation point; the spring drive arrangement for the flywheel; the optical slit; and the idea of a smooth film roller around a substantial portion of which the film is wrapped to drive the flywheel, in combination with a sprocket for feeding the film through the sound head, as for example in Fig. 2 of the patent in suit and in defendants' PS16 machine. (See Steiner's testimony as to the construction of Hoxie's first machine, supra, and see second machine, Defendants' Exhibit 45; see also plaintiffs' reply brief, pp. 59; 86-87.)

Affirmed

54. The Pedersen British Patent No. 115,942 suggests the recording of sound by a spot of light (not a line of light) in conjunction with the taking of motion pictures, and the reproducing of sound in conjunction with the projection of motion pictures, by forming a metal matrix of the wavy sound line sound record thus produced; pressing this metal matrix into the motion picture film and using a stylus for reproducing. Pedersen states in his patent at page 2, lines 29-32, that sound is exceedingly sensitive to speed variations, and in order to obviate variations in speed during the producing and reproducing operations he provides particularly large flywheels, but he does not show or describe any suggestion as to where the flywheel shall be located in his combined sound picture machine; much less does he teach that it should be secured to the film feeding

sprocket in the sound head at or adjacent the translation point. But he does state that his sound may be recorded "on the delivery drum or feed reel" (p. 2, lines 23-4) and that the sound may be reproduced by the needle located "on the winding drum or uniformly rotating transmitting drum" (line 25). As plaintiffs' witness Ballard points out, these parts at which it is said the sound is to be translated, are all well known parts of a motion picture machine. It is apparent that a delivery drum or feed reel must always rotate with a considerable variation in speed as the film is being wound from it because of the changing diameter of the roll of film coiled upon it (Tr., 1731). Without this variation in speed the reel would not properly feed the film to the film transmitting sprocket at the picture gate, but would over- or under-feed it; and the same is true with the "winding drum". If a flywheel were to be put on the shaft of either of these devices where Pederson says his sound is to be translated, it would interfere with, if not prevent the reel from functioning as it is intended to function and must function—with a continuously varying speed—in order to have the machine operate. It is therefore apparent that Pedersen did not intend to put the flywheel on the shaft of any of these devices, and if his patent teaches this it teaches something inoperative. It cannot be presumed that he teaches the use of the flywheel on the shaft of a sprocket or transmitting drum, if he does not teach the use of it on the shaft of the reels where it should not be put.

The patent is a vague foreign patent and I agree with plaintiffs' expert that it does not teach the putting of the flywheel on the shaft of any of these devices at or adjacent to the translation point.

Defendants' and plaintiffs' experts testified to the jerky motion caused by rewind and takeup reels on a film at the translation point, and to the objection of hold back sprockets for the same reason, but these are the

devices at which Pedersen proposes to translate his sound which would result in a jerky motion.

I agree with plaintiffs' expert that the patent shows many crude and inoperative features which would give wholly unacceptable sound reproduction. Defendants constructed and demonstrated at the trial many models alleged to represent various machines, but they did not attempt to demonstrate a model representing this patent although they have stressed this patent.

I further agree with plaintiffs' expert that defendants' sketch (Deft.s' Ex. 148) allegedly representing Pedersen's disclosure, is not justified by the Pedersen disclosure and Pedersen does not teach what it shows.

The Pedersen patent does not disclose the subject matter of the claims in suit and has not contributed anything of value to the practical art of sound on film recording or reproducing.

It also appears from the record that in the German nullity proceedings brought against each of the German patents directed to flywheel speed control of the film, this Pedersen patent was cited and the tribunals held that the patent did not disclose where the flywheel should be located in the Pedersen machine. For example, see in the case of Erpi v. Tri-Ergon, Defendants' Exhibit 99, translation of decision, page 11, it was held that the Pedersen patent "contains neither in the specification nor in the drawings any suggestion as to the place where the flywheels . . . are to be disposed", pointing out that there may be various places where the flywheel could be put which would not produce uniformity of motion at the place of control. (See Pedersen Pat., Deft.s' Ex. 74, Item 42; Ballard, Tr., 1698-1703; 1750-1; 1717, 1700; 1706-7; Waterman, 1360-61; 1432; explained plaintiffs' main brief, pp. 62-66, and reply brief, pp. 50-1; and Tr. of argument, pp. 129-30.)

55. Defendants set up six patents of one Cawley, of Pittston, Pa., to wit, Nos. 1,710,677, 1,825,438, 1,825,-439, 1,825,440, 1,825,441 and 1,878,577. It does not appear from the record that Cawley was ever engaged in the practical or actual development of sound on film work. Of these six patents only one of them (No. 1,825,441) was filed prior to the effective date of the patent in suit. There is a seventh Cawley patent, No. 1,594,662, not set up in the answer but introduced by plaintiffs (application and patent, Pltf.s' Ex. 62) filed in 1919. Defendants, therefore, are limited to the disclosures of the applications of these last two patents (Deft.s' Ex. 95 and Pltf.s' Ex. 62) in support of their contention that Cawley is a prior inventor to the patentees of the patent in suit, of any alleged common subject matter. Affirmed

Neither of these two patents nor their applications were, however, referred to by defendants' expert, Waterman. He only referred to Cawley patents 1,878,-577 and 1,825,438 (Tr., 1334-5), but the first of these was not filed until April 23, 1929, as an alleged division of one of the earlier applications, and the second one was not filed until September 16, 1929, as an alleged division of another of the said earlier ones.

Some of these six patents were filed some months after the grant of the patent in suit, and others, including the one set up which was filed early enough to be considered (No. 1,825,441) was still pending when the patent in suit issued, and was not granted until September, 1931.

I find no statement in this last patent (1,825,441) or the application therefor (Deft.s' Ex. 95), or in the only other application that is early enough (Pltf.s' Ex. 62), or in the patent that issued thereon (No. 1,594,662) with respect to obtaining uniform speed by a rotating member of considerable mass or by flywheel effect or

the like. It appears that all statements directed to these ideas were introduced after the grant of the patent in suit, which the application files show that Cawley had considered. It also appears that R. C. A. acquired some of these Cawley patents after the patent in suit issued (Pltf.s' Exs. 70-71).

In one of the two applications filed early enough (Pltf.s' Ex. 62), the apparatus disclosed in one suggesting the recording of sound by stylus on a film. The stylus rests upon the film where it passes over and around a portion of a 32-tooth size motion picture sprocket. There was no suggestion of any heavy weighty mass or flywheel effect resulting from the use of this sprocket to control the speed of the film, and the size of a 32-tooth sprocket negatives any such idea. A sprocket of this size in evidence (Pltf.s' Ex. 74) measures less than 1⅞ inches in diameter. There are sprockets here in evidence from 16-tooth to 54-tooth for feeding film in sound heads (plaintiffs' and defendants' machines and Deft.s' Ex. 79), but in all cases they have a flywheel secured to their shaft to give the desired speed control. The idea of flywheel control from Cawley's 32-tooth sprocket is further negatived by the fact that it is described and shown as having a substantial thickness of some relatively light material at its periphery where weight is most important for flywheel effect. In April, 1929, Cawley filed another application (Pltf.s' Ex. 61) showing this sprocket as a 16-tooth size with the light material at the rim, and he no longer called it a "large" sprocket.

No importance can attach to the statement in this Cawley application (Ex. 62) that it is highly desirable that the film should be held perfectly rigid while moving at an absolutely uniform rate of speed, because in another Cawley patent (No. 1,420,304 filed the same year, 1919; Pltf.s' Ex. 64; p. 3, line

50) Cawley states "An absolutely uniform speed is necessary for sound recording, and for this reason the camera should be driven by some form of motor".

The original Cawley application (Pltf.s' Ex. 62) does not disclose the use of a flywheel or heavy rotating mass at or adjacent the translation point for obtaining uniform speed, and any momentum effect for that purpose resulting from the use of his 32-tooth sprocket is wholly unappreciable. This application discloses no recording of sound by light nor various other features which the claims of the patent in suit call for in combination with it. (See application, Pltf.s' Ex. 62, and application, Deft.s' Ex. 95, and files of the other Cawley applications mentioned, Pltf.s' Exs. 61 to 71; also Ballard, Tr., 1798-1803; discussed in plaintiffs' main brief, pp. 71-79.)

As to the other Cawley application filed early enough (Deft.s' Ex. 95), defendants' expert, Waterman, did not refer to this either; he did refer to Cawley patent 1,825,438, not filed until September, 1929 (after the patent in suit issued), and as an alleged division of the earlier application, but even as to this he merely briefly mentions it in about sixteen lines (Tr., 1335), and does not undertake to explain how a machine of this construction could operatively function. Plaintiffs' expert, Ballard, discusses said original application (Deft.s' Ex. 95), and the patent that issued thereon (No. 1,825,441), pointing out that the film moves in one direction over a sprocket or wheel, and that an arm pivoted coaxial with the wheel, revolves in the opposite direction carrying either a stylus for scratching a record longitudinally of the film or carrying an incandescent lamp for the purpose of recording the sound. The arm is rotated through a chain of gears. There is no suggestion of any flywheel effect being given the film for speed control by the sprocket or wheel shown,

and even if it were possible to produce any flywheel effect on the film by the construction disclosed, there would be no flywheel speed control of the revolving sound recording arm. Speed control of the film without speed control of the arm carrying the stylus or lamp would not give uniform speed control to the sound record, for it is the *relative* motion of the stylus and film that governs the recording. There is no fixed translation point in the device and no provision is shown for making an operative sound record by the revolving incandescent lamp, and as to the stylus recording, this has to engage and disengage the record at intervals during each rotation of the arm, and plaintiffs' expert states that such intermittent contacting of the stylus with the film would produce loud noises on the sound record occurring at rapid intervals which would sound like a machine gun and overpower any sound reproduction. He also criticized the patent on various other features, such as the inoperative arrangement of the selenium cell, and I agree with his undisputed testimony that the Cawley devices shown in said original application (Deft.s' Ex. 95) and in the Cawley patent 1,825,441 based thereon, and in the other Cawley patents alleged to be based thereon, including patent 1,825,438, mentioned by Waterman, are completely inoperative. Defendants did not attempt to demonstrate any Cawley model among the many other devices demonstrated by them.

Cawley is not a prior inventor of the subject matter of the claims at issue. (See Deft.'s Ex. 95; and Cawley patents mentioned; Ballard, Tr., 1803-07; explained plaintiffs' main brief, pp. 79-85, and reply brief, pp. 52-54.)

Affirmed

56. The Dragoumis patent is a foreign patent. It shows a machine having a loop of celluloid strip

passing over a drum upon which it is proposed to record sound in a series of loops by having the stylus carriage move transversely of the strip. This carriage is moved by a feed screw and it is stated that the strip may be advanced at a much reduced speed in order to get a greater amount of sound on the loop, for which purpose the record may be made on both sides of the loop. The sound is not recorded by light on a photographic film. As plaintiffs' expert points out, the stylus carriage is moved by a feed screw geared by a train of gears to the shaft carrying the film feeding drum, and there is another train of gears connected to the feed screw shaft for operating an indicator; all of this mechanism causing heavy irregular loads upon the shaft of the film drum, and it is impossible with this apparatus to obtain uniformity of speed of the drum suitable for sound on film, since this mechanism involves inherent irregular loads on the shaft. Defendants' expert admits that the patent does not mention a flywheel much less the effect of one in the control of speed; and it does not refer to uniformity of speed.

The patent shows a spoked pulley on the shaft with the film drum, which is not mentioned in the specification, much less is any suggestion given as to its being a heavy pulley, or of what material it is made. For all that appears in the patent, it may be made of aluminum, wood or fibre. In answer to an inquiry in defendants' reply brief, as to whether plaintiffs ever saw a wooden wheel with spokes shaped like Dragoumis' pulley, one was exhibited to the Court at the argument, said to have been a part of Ruhmer's original machine for recording sound on film, but this is not of record. While in some relatively large flywheels such as those used in steam engines and the like, spokes are used; a spoked pulley used in this type of apparatus is indicative of the absence of any idea of flywheel effect.

Defendants demonstrated an alleged model of this machine using a brass pulley on the roller shaft, but omitted from it all of the above stated train of gears; feed screw, carriage and indicator, which would produce irregular loads on the pulley shaft. They admittedly did not use the hill-and-dale type of record of Dragoumis, but a laterally cut record admittedly specially gotten up for the demonstration, and admittedly such a record had never been produced before by the laboratory which produced said record for the demonstration, and admittedly a modern electric pickup system was used for the reproduction in lieu of the feed screw carriage and stylus of Dragoumis, and of a type which had only existed for the last two or three years, made by the Bell Laboratories under instructions to make the best. Such a pickup gives a minimum of irregular loads on the film drum shaft.

The model demonstrated was clearly not made or operated in accordance with the Dragoumis patent and the results obtained cannot be accepted as results obtainable from Dragoumis' teachings. Furthermore, the model was only demonstrated with speech and spirited music which, as plaintiffs' expert points out, would give little or no indication of speed fluctuations.

I agree with plaintiffs' expert that the Dragoumis patent does not teach anything with reference to the patent in suit. It does not disclose the idea of speed control by a flywheel or heavy rotating mass, and it does not disclose the subject matter of any of the claims at issue. It does disclose arcuate bending of the celluloid strip where sound is recorded by stylus, but as pointed out by plaintiffs' expert, the various problems solved by the arcuate bending of the film in the patent in suit are special to the recording and reproducing of sound by light. (See Dragoumis patent; Ballard, Tr., 1483-88; 1712-13; 1461; Waterman, Tr., 1328; 1165; 1407; 1415; 1417; explained plaintiffs'

main brief, pp. 66-70 argument, Tr., pp. 47-48.)

The Dragoumis patent was a reference in the file of the patent in suit (Pltf.s' Ex. 1) and it was set up in the various German nullity proceedings against the Vogt, et al. German patents, and was thrown out for lack of disclosure. In one of these proceedings (Deft.s' Ex. 99, Erpi v. Tri-Ergon, translation of decision, p. 10) it is stated:

> "In French patent 472,467" (Dragoumis) "the spoke wheel of Fig. 1 is the main driving wheel of the equipment of which nothing is said that it should have a large mass. In that it is shown as a spoke wheel its mass of itself is also small, and it would only act as a flywheel if it were made of a particularly heavy substance. But nothing is contained in the patent specification as to this."

(See also Deft.s' Ex. 103, E. R. P. I. v. Tri-Ergon, translation of decision, p. 5.)

57. The Bell & Tainter patent No. 341,214, shows two or three types of machines. The particular form here relied upon by defendants is shown in Figs. 18 and 19. In this form it is proposed to record sound upon "a wax-coated strip R of paper" which passes directly from a delivery reel U over a part of the circumference of a disk S on a shaft P, thence directly to a rewind reel T. Both of these reels are belt driven from the shaft upon which the said disk S is mounted, and four friction clutches are provided between the reels and their driving pulleys. A stylus is provided resting upon the paper strip at the periphery of the disk S for recording the sound. The shaft P carrying disk S is also provided with a disk Q which is driven by a tangential friction drive in the form of a rubber roller G rotating in contact with the disk Q and driven by a hand cranked flywheel 8. Affirmed

As plaintiffs' expert points out, the flywheel is not on the shaft with the disk S but is on the driving shaft with the interposed tangential friction drive above mentioned, which would result in slippage and relative rotation between the flywheel and the disk S feeding the film, and thus will be prevented from giving uniform speed to the disk. As he also points out, the Jamieson British patent No. 2,814 (Deft.s' Ex. 74) shows a tangential friction disk drive for the purpose of permitting slippage between the frictionally engaged parts. Unformity of speed of the strip of paper R would also be prevented because of the direct pulling of the strip by the drum from one rewind reel past the translation point, and the pulling of it by the other rewind reel from the translation point, which both experts agree would cause a jerky motion at the translation point in a sound recording or reproducing machine (Waterman, Tr., 1360-1; 1432). As plaintiffs' expert points out, the irregularities in speed would be accentuated by the friction clutches above mentioned which would add considerably to the irregular loads being placed upon the shaft P by the reels; and the arrangement disclosed would be bound to create irregularities in speed of the strip.

The flywheel is not on the drum shaft at the translation point. The device disclosed cannot produce uniformity of speed suitable for sound recording on a film and the patent does not disclose the subject matter of any of the claims at issue.

Defendants produced an alleged model of this device but they did not demonstrate its operation to the Court or to plaintiffs' representatives. (See patent and Ballard, Tr., 1715-18; explained plaintiffs' main brief, pp. 60-62.)

Affirmed

58. The Trowbridge patent was filed earlier than, but did not issue until after the filing of the patent in

suit. It is not a device for sound recording or reproducing. The patent is entitled "Recording Indicator". The device is described as used for the "investigation of the gas pressures in a high speed internal combustion engine". Defendants' witness, Duryea, states that it was used "to take many records of the explosion pressures in gasoline engines". Briefly, stated, it is a machine which records the *rate* of changes in pressure for example in such devices as a gas engine, upon a strip of paper. Transverse parallel lines are also recorded on the strip at definite time intervals for measuring the rate of change of the pressures. The strip is fed by two smooth surface friction pinch rollers past the recording point, whereupon the strip of paper only a few inches long on which the record is made, is cut off and automatically passed through a developing compartment constituting a part of the machine. All of this mechanism is driven from the same driving shaft. The device is a combined pressure recorder and developer.

Defendants' witness states that the short strip is passed through the recording compartment in about one second. The patent is cited because it is contended that a flywheel shown and described is on the shaft of one of the smooth rollers. In the drawings of the patent (Fig. 14) the flywheel does not appear to be on the shaft of the roller because the two are out of alignment, but in the model produced by the witness the flywheel was shown on this shaft. The operation of the model was not demonstrated to the Court. As plaintiffs' expert points out (and defendants' witness agrees with him), the record made by the machine is not a true record of pressure, vibration or sound, but is merely a record of the rate of change in pressure. Plaintiffs' expert also states that if one sought to reproduce such a record he would get an absolutely unintelligible result; and such a record cannot be re-

produced into sound regardless of other difficulties with the machine. Defendants' witness admitted that with the machine he only got an approximately uniform speed; that uniformity of speed was not necessary for the proper intended use of the apparatus; that the time interval in the pressure curve would be correctly shown "regardless of the variations in speed of the apparatus". He also produced pressure records in his original notebook, made by the machine, and admitted that they showed variations in speed. The "characteristic curve" of the device as shown in the notebook, showed oscillations. Plaintiffs' expert testified that the records presented in the notebook showed that they had not moved through the machine at anything like constant or uniform speed, and that the arrangement and construction of the apparatus was such that uniformity of speed could not be obtained.

The Trowbridge patent is non-analogous art; the device did not produce, and appears to be incapable of producing uniformity of speed of the record strip, and it does not teach anything with respect to the problems solved by the invention of the patent in suit, and does not meet any of the claims at issue. (See Ballard, Tr., 1707-10; Trowbridge, 1063-64; 1075; 992; 1066-68; 1078-9; 1080-81; explained plaintiffs' main brief, pp. 90-93.)

Affirmed

59. The Ries patents show a sound on film sound picture machine, but as plaintiffs' expert points out,—and his testimony is not contradicted,—the patents do not show or suggest a flywheel or speed control by one. The film is pulled from the translation point by a rewind reel which will not give uniform speed. The patents do not show a photoelectric cell or an optical slit or the arcuate bending of the film at the translation point, but have a mechanical slit and a selenium cell.

The patents do not disclose the subject matter of any of the claims at issue. (Ree Ries patents; Ballard, Tr., 1703-7; 1710-11; explained plaintiffs' main brief, pp. 70-71.)

The original application for one of the patents was filed prior to the patent in suit but both patents were granted after the application date of the patent in suit.

60. As to the earlier cylinder and disk gramophone patents and devices of Edison and others; I agree with plaintiffs' expert that the application of flywheel control to the film as it passes through the sound head so that each successive length of the light flexible film as it passes the translation point, will have given to it the property of a weighty mass, to give uniform speed to the film, involves a distinctly different problem and is a different thing from these cylinder and disk gramophones where a cylinder or disk record is placed upon a mandrel or plate to rotate therewith, and which because of their weight or that of some added momentum device on the shaft, provide considerable momentum for equalizing irregularities in speed. Defendants' expert in discussing the patent in suit and defendants' machines, points out that "impulses coming from the picture projector or from splices in the film or from inequalities of gears or bad sprocket holes" will set up irregularities in speed. Obviously all of these features are not present in cylinder or disk gramophones and hence the problem of avoiding speed irregularities caused thereby and the means for avoiding it, are not present in such machines. Defendants' expert Hammond, who operated the old Edison gramophones, including the Kinetophone, and who has operated sound on film sound picture machines for several years, states that there is an entirely different condition existing in these sound on film machines, Affirmed

and admits that there is an entirely different problem in the two types of machines and that there are entirely different problems to meet. (Ballard, Tr., 1695-6; Hammond, Tr., 700, XQs206-10; 703, XQ228; Waterman, top, Tr., 1148; explained plaintiffs' main brief, pp. 6-8; 52-3; reply brief, pp. 43-45.)

Affirmed

61. As shown from the specification, the patent in suit was granted with the understanding, and with the acknowledgment in the specification, that such cylinder and disk gramophone devices were known.

In an opposition proceeding brought in the German Patent Office against one of the German patents directed to the idea of application of flywheel speed control to linear sound carriers, some of these gramophone patents here relied upon were set up including Edison, No. 227,679, the one chiefly stressed in this suit; but the German tribunal disregarded them as affecting the patent there, with the statement—

> "In that in the subject matter of the attacked patent there is involved an improvement in the drive of a *linear* sound record all of those patent specifications in which a linear sound record carrier is not used are of no interest, for in these the problem solved by the attacked patent is not present," etc. (See specification of patent in suit, p. 1, lines 13-28, explained plaintiffs' main brief, pp. 6-7; 52-53; Deft.s' Ex. 99, Erpi v. Tri-Ergon Holding Co., et al., translation of decision, p. 10.)

Affirmed

62. Edison patent No. 227,679, of 1880, appears to be the principal cylinder or disk gramophone patent relied upon by defendants. It shows a machine with a single shaft having hereon the cylinder mandrel, and at one end a flywheel with a crank handle; the shaft with its cylinder and flywheel are moved endwise through the bearings as the shaft rotates by a feed screw on the shaft. In this patent Edison mentions

the desirability of great uniformity of speed, and states that to attain this he uses an abnormally heavy flywheel upon the shaft of the phonograph. But this shaft is also the driving shaft and the flywheel is at the driving point. The patent does not teach the importance of having the flywheel directly on the shaft with the mandrel, as distinguished from having it on some other driving shaft if more than two were to be used in the machine; and Edison's subsequent patents, Nos. 386,974, 499,879 and 513,095, show that he himself did not understand from the disclosures of his first patent, the desirability or importance of having the flywheel on the shaft with the mandrel, as distinguished from placing it at some other location such as on the driving motor shaft or in the driving motor.

In his second patent, No. 386,974, of 1888, he eliminates the flywheel from his horizontal mandrel shaft and locates it down in his driving motor on a vertical shaft, which is geared to the mandrel shaft by tangential bevel friction gearing, which of itself is subject to slippage with respect to the driven mandrel; and he provides a governor for controlling the speed. In his next patent, No. 499,879, of 1893, he again eliminates the flywheel from the horizontal mandrel shaft and builds his motor armature of considerable size to act as a flywheel, and places this on a vertical shaft belted to the mandrel shaft. In his next patent, No. 513,095, of 1894, he eliminates the flywheel entirely from all parts of his machine and utilizes centrifugal ball governors actuating a brake for controlling the speed of the machine.

The prior cylinder and disk gramophone patents and devices do not contain the subject matter of any of the claims at issue. (See said patents; Ballard, Tr., 1721-25; explained plaintiffs' main brief, pp. 53-56.)

Affirmed

63. The Edison Kinetophone machine without the connecting belts and synchronizer to his motion picture machine, was demonstrated with two old Edison records, one of which admittedly had only been used a few times and was in fairly good condition (Tr., 772). As plaintiffs' expert points out, the records were not of a character to test speed constancy but the reproduction was poor. (Ballard, Tr., 1450-51; plaintiffs' main brief, p. 96.)

Affirmed

64. As to the other demonstrations of the Edison Kinetophone and Triumph machines, admittedly the machines were not demonstrated as constructed and intended to be operated. Admittedly in the demonstrations the mechanical stylus with the feed screws, clamp nuts, and gearing for driving the same, were not used, but instead a modern electric playback pickup was used giving the very slightest pressure that would make a track, and wax records were used of a character which had to be kept in a refrigerator so that they might be played more than once.

As plaintiffs' expert points out, the omitted parts are inherent component parts of the machines and are sources of substantial friction and irregular loads on the mandrel shaft. He points out that the omission of this stylus mechanism would have a very large if not a controlling significance as regards uniformity or non-uniformity of sound reproduction; that the soft wax records used would be obliterated by the usual stylus pressure, and that the electric pickup used was a delicately balanced modern one exerting very little pressure on the records.

I agree with plaintiffs' expert that these demonstrations did not give an indication of how the machines as originally constructed and operated, would function either as to speed constancy or quality of reproduction. (Waterman, Tr., 1404, XQs160-61; 1406,

XQ172; 1407; 1410; 1414-15; Ballard, 1663-68; 1469-70; 1494-96; 1869; XQ1171 explained plaintiffs' main brief, pp. 102-4; see also pp. 95-101.)

65. Defendants have cited no prior art, teaching or suggesting the advancing of the film through a sound head by a sprocket with the film contacting with a substantial portion of the periphery of a cylinder associated with a flywheel and located between the sprocket and the sound translation point; so that the record is advanced uniformly under the control of the flywheel, and the small irregularities due to the sprocket engagement with the film are effectively prevented by the cylinder from reaching the translation point. The relationship of these features as set forth in the combination of claim 17 is new and useful and is embodied in defendants' PS16 apparatus. (Ballard, Tr., 513-14; 515-17; 591-2; 595-7; plaintiffs' main brief, pp. 9-10; 24-26.) Affirmed

66. None of the prior art spring drive devices relates to sound on film sound heads (Holst, Amet, Jamieson, Constable, Galley, Royce French Pat. 10,377); and none of them discloses the combination of claim 7 of the patent in suit, involving as one of its elements, a resilient connection located between a flywheel mounted on the shaft of a film engaging cylinder and a coaxial driving member for said shaft. The combination of claim 7 is new and useful and is embodied in defendants' PS1 apparatus. (See said patents; Ballard, Tr., 1470-73; 1741; 1736-7; 1785; explained plaintiffs' main brief, pp. 87-89.) Affirmed

67. The German decision on the nullity proceeding against the German Patent of Addition No. 389,317, for the spring drive, holding that patent invalid, involved a different situation from that presented here with re- Affirmed

spect to claim 7 of the patent in suit, and is not a precedent for the situation here. In the German situation, sound head apparatus without the spring drive was the subject matter of the main German patent. The patent of addition showed only the driving member and flywheel with the spring connection. According to a German Supreme Court decision cited by defendants' expert on German law, it would appear that the subject matter of a German patent of addition to be valid, must disclose subject matter beyond that of the main patent, which *additional subject matter over that of the main patent,* must be of inventive character as compared with the state of the art to be considered, but not including the main patent as a part of the art. This is not the situation with respect to claim 7. In this country there is no main patent for a part of the invention covered by the claim; the patent in suit involves the whole sound head apparatus including the spring drive, and claim 7 is for a combination of elements of that apparatus including the spring drive as one of them. (See German patent of addition 389,317; Dr. Mueller, Tr., 1510, Q18, and authorities cited; Tr., 1518, Qs47-8; plaintiffs' reply brief, pp. 73-75.)

Affirmed

68. The Terwilliger and Anderson patents showing a curved motion picture gate, do not meet claim 9 of the patent in suit, including the feature of flexing the film arcuately at the translation point of a sound head where the sound is recorded by light, and would not teach one to do this in a sound head. Plaintiffs' expert points out that it has been known for many years that picture film must be kept as flat as possible at the gate, for any departure from this would throw the picture out of focus on the screen, and that the curving of the film at the gate would throw the picture completely out of focus on the screen. Defendants do not use a curved surface at their motion picture gate but do curve

the film at the translation point in the sound head. (Ballard, Tr., 1762; plaintiffs' main brief, pp. 93-4; reply brief, last par., p. 87.)

69. The patents cited to show photoelectric cells (Compton, Kunz, Hull and Langmuir, some of which were not issued until after the patent in suit was filed) do not disclose or suggest the use of the photoelectric cell for sound recording, or that it is desirable for that purpose, much less do they disclose the combination of claim 13 of the patent in suit involving that feature as an element. (Ballard, Tr., 1780; 1782; 1784; Pltf.s' Ex. 10, Findings 21 and 23; explained, plaintiffs' main brief, pp. 108-9.) Affirmed

70. As to the main German patent No. 387,058, the two forms of apparatus shown therein are different from each of the various forms shown in the patent in suit. Several features included in the combinations of the claims at issue are not even disclosed in said German patent, such for example as the spring drive, the arcuate bending of the film at the translation point, and the special arrangement of the film feeding sprocket in combination with a cylinder over a substantial portion of the periphery of which the film is engaged between said sprocket and the translation point. In the German patent the film passes between two smooth tangentially engaging friction or pinch rollers in a straight line to and through the guides at the translation point. Only this kind of engagement is relied upon to cause the flywheel on one of these rollers to be driven by the film without slipping, to give the film the desired uniformity of speed of the flywheel. Affirmed

That slipping will take place between the film and the flywheel roller in such an arrangement is shown from the construction of Fig. 2 of said German patent where there are two such sets of film engaging

pinch rollers spaced apart and driven at different speeds to keep the film under tension; and defendants' expert admits that in this construction there must be some slippage between the film and one of the pairs of pinch rollers. (Tr., 1425, XQ249.)

Dr. Engl testifies that this German application was filed when they had the first crude idea about the importance of applying a flywheel, and that the application was filed without having tried out the feature, but they quickly decided that the construction would be of no use because it would not operate in the way it is shown in that patent, and that "it is impossible to keep the film by these means in a steady motion of constant speed which we desired." (Tr., 260-62.)

Defendants built an alleged model (Deft.s' Ex. 78) of Fig. 1 of the German patent to demonstrate its operation; but I agree with plaintiffs' expert that the model as demonstrated to the Court has several features in it important to its operation, which are not suggested or justified by the German patent. The operation of the model, therefore, did not establish the operativeness of the device of the German patent. (For comparison see Fig. 1 of the German patent and sketch of defendants' model, Pltf.s' Ex. 46.)

Plaintiffs' expert points out the roughness of the clamping plate at the gate in this model, which is pressed on the film with an inordinate heavy pressure of several pounds, and the condition of the surface of one of the pinch rollers which under the heavy pressure used on that roller, would damage the emulsion on the film. Upon examining the film which was run through the machine he points out scratches and abrasions on the film. He also points out the feature of swiveling the upper pinch roller, and that the model also embodies certain features for preventing the weaving and slipping of the film enunciated in an article published in 1930 by one Kellogg, an engineer of

R. C. A.; for example, the roller around which the film is bent to change its direction, etc. (Pltf.s' Ex. 44, p. 653, at pp. 664-5) who was present throughout the trial.

It appears that after the demonstration to the Court, upon plaintiffs' request a demonstration was given by defendants reducing the spring pressure at the gate but keeping it strong enough to hold the plate in proper position, and with this change very pronounced irregularities in speed occurred such as to make the device entirely impossible from a commercial standpoint; that another change with regard to the feed sprocket was requested and made, and that in this "the result was terrible". Defendants have not disputed any of this testimony.

On the evidence before me I find that defendants' model embodies features from the Kellogg article necessary to its operation and not justified by the German patent, and that the apparatus of the first German patent is inoperative to produce uniformity of speed suitable for sound on film recording and reproducing. (Ballard, Tr., 1475-78; 1496-7; 1676-7; 1679-83; 1885-6; 1915; see plaintiffs' main brief, pp. 138-47.)

71. Defendants have set up about seventy United States and foreign patents against the patent in suit, but although urged by plaintiffs (before and during the trial) to do so, they did not point out any one or more of them as an alleged anticipation of any of the claims at issue, unless it be Pedersen as argued in their brief; but the uncontradicted testimony is that Pedersen's apparatus is inoperative. (See citations to finding 54.) Affirmed

72. That each of the features by which the claims in suit are qualified by disclaimer, was shown and de- Affirmed

scribed in the application for the patent as filed and in the patent as granted. (See disclaimer Pltf.s' Ex. 2; original application Pltf.s' Ex. 1; patent in suit; pointed out and explained in plaintiffs' reply brief, pp. 25 to 30.)

Affirmed

73. That the various elements of each of the combinations and methods of the claims at issue are directed to distortionless sound reproduction from sound on film and co-operate one with another to produce it. (Tr., 522-3; 529, Qs42-3; Tr., 868; and citations to findings Nos. 5, 7, 8, 9 and 10; and Tr. of argument, 136.)

Affirmed

74. That the combinations and methods of the claims at issue are not found in any of the prior art citations and are new and useful.

PLAINTIFFS' PROPOSED CONCLUSIONS OF LAW.

Affirmed

1. The claims at issue, as found in finding of fact 23a, cover combinations of apparatus features and method steps which enabled the successful establishment of a new art (reproduction of sound from film records by the use of light). Anticipation of such claims is not made out by selecting a part from one prior art citation and parts from others or by modification of prior art devices which were not designed, adapted or actually used for the purpose. (Topliff v. Topliff, 145 U. S. 156; Line Material Co. v. Brady, 7 F. [2d] 48; Hobbs v. Beach, 180 U. S. 384.) (Other authorities, plaintiffs' main brief p. 125; reply brief, pp. 62-3.)

Affirmed

2. The patent in suit is entitled to a pioneer status and should be liberally and favorably construed

since it covers combinations and method steps enabling the first successful sound reproduction with film records by the use of light. (Curtiss Aeroplane case, 278 F. 454; Window Glass case, C. C. A. 3rd, 261 F. 362, at p. 370; Sessions v. Romadka, 145 U. S., at p. 45.)

3. None of defendants' citations anticipates the claims at issue since none gives in substance the same knowledge and the same directions as the specification of the patent in suit (for example, none discloses apparatus or methods capable of successfully reproducing sound by light from film records). (Skelly Oil v. Universal Oil, 31 F. [2d] 427, C. C. A. 3rd.) (This and other authorities, plaintiffs' main brief, pp. 124-6; reply brief, pp. 62-4.) Affirmed

4. The invention of the claims at issue is of patentable merit, involving, first, the discovery of the sources of difficulties causing distortion in the reproduction of sound by light from film records, and second, the application of the remedies for such difficulties. (Eibel Process case, 261 U. S. 43; Consolidated v. Window Glass Mch., 261 F. 362, C. C. A. 3rd; plaintiffs' main brief, pp. 125-6.) Affirmed

5. The patentees were entitled to secure in the patent in suit their actual invention as disclosed in their original drawings and specifications and were entitled to amend their claims while their application was pending without regard to the nature or scope of the claims originally made and regardless of competing devices put out shortly before the granting of the patent in suit. (Heller Bros. v. Crucible Steel, 297 F. 39, C. C. A. 3rd, and other authorities, plaintiffs' reply brief, pp. 18-19.) Affirmed

Affirmed

6. The alleged failure of the patent in suit to mention all of the merits and advantages of the combinations and method steps disclosed and claimed, does not invalidate the claims. (Mead-Morrison v. Exeter, 225 F., at 496, C. C. A. 3rd; plaintiffs' reply brief, p. 19; U. S. Mitis Co. v. Midvale, 135 F. 103, C. C., Pa., J. Archbald; Holton v. Pepper, 216 F. 368, D. C., Pa.)

Affirmed

7. The combinations and methods of the claims in suit were adequately disclosed under the provisions of R. S., 4888, in the application for the patent in suit as originally filed. (See citations for proposed findings of fact 6-10.)

Affirmed

8. Claims 9, 18 and 19 of the patent in suit are valid method claims and may properly be included in the same patent with the apparatus claims. (Compare with form of Berliner phonograph method claim 5 of Leeds & Catlin case, 213 U. S. 301; and method claims of Window Glass cases, 261 F. 362, 18 F. [2d] 63, opinions by J. Buffington; other authorities, plaintiffs' main brief, pp. 64-7.)

Affirmed

9. Patents which are inoperative or useless for the purposes of the patent in suit are not anticipations for the latter. (Consolidated v. Window Glass Mach., 261 F. 362, C. C. A. 3rd, other authorities, plaintiffs' main brief, p. 79.) The following citations of the defendants are therefore incompetent. Pedersen—(inoperative—see finding of fact No. 54); Cawley patents—(all either inoperative or useless for the purpose—see finding 55); Trowbridge—(inoperative for sound reproduction or to produce uniform motion —see finding 58); Bell & Tainter—(demonstration of operation not given and impossible for producing uniform motion suitable for sound on film reproduction by light—see finding 57); Ries—(impossible to obtain

uniformity of speed suitable for sound on film reproduction by light and uses selenium cell which distorts sound; see finding 59); Terwilliger—(inoperative for intended purposes in picture machines—see plaintiffs' main brief, p. 93, Argument, Tr., 133); Bock—(inoperative, Tr., 1751); Cooley—(inoperative, Tr., 1755); Dragoumis—(impossible for producing uniform motion suitable for sound on film reproduction by light —see finding 56).

10. The rule as to anticipation by a foreign patent or publication is very strict. A foreign patent or publication is to be measured as anticipatory not by what might have been made out of it but by what is clearly and definitely disclosed in it. (Seymour v. Osborne, 11 Wall. 516; Carson v. Am. Smelting, 4 F. [2] 463, other authorities, plaintiffs' main brief, p. 65.) Therefore the British patent to Pedersen, the Dragoumis and General Phonograph French patents, the Rankine article and the Duddell British patent, none of which teaches the invention of the claims of the patent in suit, cannot be used as anticipations and the devices thereof cannot be modified for such purpose. Defendants' expert's sketch (Deft.s' Ex. 148) which involves unjustified interpretations and modifications of the Pedersen patent is incompetent.) (See finding 54.) Affirmed

11. Citations from non-analogous prior art cannot be used as anticipations. (Koppers Case, 258 Fed. 122, C. C. A. 3rd, other authorities, plaintiffs' reply brief, p. 64.) Therefore defendants' following citations are impertinent for the reasons noted: Trowbridge —indicator of rate of change of pressures, as in gas engines; Galley—hand organ; Holst, Momyer, Terwilliger and Anderson—picture apparatus not involving sound; Jamieson British patent—governor for Affirmed

power motors; Royce British patent—for prime movers such as automobile drives. Also flywheels used on picture projector mechanism—not involving sound or any requirement for uniform motion. (See said patents and findings 37, 38, 58, 65.)

Affirmed

12. The patents to Cawley relied upon (1,878,577 and 1,825,438), Ries, Trowbridge, Constable, Kunz and Compton, and Clark patent 1,388,515, were not granted until after the filing of the application for the patent in suit or until after the effective German application filing dates thereof, and hence said patents neither comprise anticipations nor prior art in respect to the patent in suit. The applications of such later patents could only be used to show prior invention. None of the applications for said patents show prior invention of the subject matter of the claims at issue. (Authorities, see John-Pratt Co. v. Freeman, 201 F. 356, affd. 204 F. 288, C. C. A. 3rd; Ladd v. Walker, 7 F. [2d] 72, C. C. A. 3rd, and by the Court of Customs and Patent Appeals, In re Spencer, 47 F. [2d] 806 [1931]; Allied Metal v. Standard Electric, 57 F. [2d] 296; Farmers' Handy Wagon Co. v. Beaver, C. C. A. 7th, 236 F. 731; and other authorities, see plaintiffs' main brief, pp. 126-8.)

Affirmed

13. Anticipations are not made out by the operation of prior devices with important or essential parts discarded. (See plaintiffs' main brief, p. 68, etc., Eck v. Kutz, 132 Fed. at 779, C. C., Pa., J. Archbald); therefore no weight can be given to the operation of alleged models and parts of various Edison phonographs, Dragoumis, Amet spring connection, and Constable.

Affirmed

14. An unappreciated use does not anticipate (Tilghman v. Proctor, 102 U. S. at 711, other authorities, plaintiffs' main brief, pp. 87 and 116); therefore

the first Hoxie machine with alleged brief early and unsuccessful use of flywheel, later discarded, even if it had been established as early enough, is incompetent as an alleged anticipation of the flywheel control feature of the claims at issue because the use of the alleged flywheel was not for the purpose of obtaining flywheel speed control but was for the purpose of providing a crank and a pulley. (See citations for findings 46 and 47.)

15. Defendants are under the burden of proving alleged prior uses beyond reasonable doubt. The oral testimony upon which the proofs rest as to the first Hoxie machine and its details of construction, alleged to be a prior use as to certain of the claims, is incompetent and insufficient to establish the facts with the required degree of certainty. (Eibel Process Case, 261 U. S. 45; other authorities, plaintiffs' main brief, p. 113.) Affirmed

16. The alleged crude Story device constitutes merely an abandoned experiment since the work was conducted in private, was unsuccessful, resulting in absolutely nothing useful and no patent application was filed thereon. (Consolidated v. Window Glass Mach., 261 F. 362, at 370, C. C. A. 3rd.) Affirmed

17. The Hoxie work constitutes merely abandoned experiments since the work was conducted in private, resulting in nothing useful, no commercial reproducers were put out and no patent applications were filed until years later after the patentees had demonstrated the value of the invention of the claims at issue. (Bijur v. Kennington, 278 F. 313; see other authorities, plaintiffs' reply brief, p. 87; main brief, p. 111.) Affirmed

Affirmed

18. The commercial use of the invention of the patent in suit by the patentees in Germany following the completion of their invention and long before others, and the commercial use of the invention continued by their licensees; the extensive use of the invention by others since, and the fact that the invention has completely replaced disk sound pictures is persuasive of the novelty and patentability of the invention. (Eibel Process case, 261 U. S. 45; Diamond Rubber v. Consolidated, 220 U. S. 428; plaintiffs' main brief, pp. 15-19; reply brief, pp. 95-96.)

Affirmed

19. The unsuccessful efforts of others to obtain satisfactory sound on film sound recording and reproducing by light prior to the patentees' date; of Dr. Story with the aid of other scientists of the General Electric Co.; of Prof. Rankine, of Dr. Lee DeForest, even shortly after the patentees' date, of Hoxie and the fact that the Western Electric Co., although it had a sound on disk sound picture machine in use in the summer of 1926, did not put out sound on film sound picture machines until some months after it had had access to Dr. Engl's Tri-Ergon machine and had his advices in the matter, comprise persuasive evidence of the novelty and validity of the patent. (Am. Stainless Steel Co. v. Ludlum, 290 F. 103, 105, C. C. A. 2nd; Todd v. Safe-Guard, 291 F. 613, 614; Eibel Process case, 261 U. S. 47, 71; G. E. Co. v. Mallory, 294 F. 562.)

Affirmed

20. The efforts of the R. C. A., who is defending these suits, to secure rights thereunder, comprise persuasive evidence of the novelty and validity of the patent. (Schenck v. Diamond Match, 77 F. 208, C. C. A. 3rd; Bostock v. Goodrich, 21 F. 316, C. C., Pa.; see plaintiffs' main brief, pp. 21-23; Pltf.s' Ex. 13.)

Affirmed

21. Defendants' citation of many prior art references (about seventy), none showing a solution of the

problem presented, is persuasive evidence of novelty and validity of the invention and of the patent in suit. (See Ball & Roller Bearing Co. v. Sanford Mfg. Co., 297 Fed. 163; Handy v. American Flyer Mfg. Co., 44 Fed. [2d] 633; plaintiffs' main brief, pp. 30-31.)

21a. R. C. A., which is defending these suits, cannot with good grace deny the novelty and patentability of the invention in view of the patents issued to it and its deliberate and persistent efforts in claiming for itself as novel and patentable various features of the patent in suit (although in fact it had no right to such claims because of lack of disclosure or inoperativeness of the devices of the original applications and the late dates of others). (See discussion of R. C. A.'s efforts with Cawley patents, plaintiffs' main brief, pp. 128-130; reply brief, p. 54; see discussion other R. C. A. patents, plaintiffs' main brief, pp. 14, 131; authorities, Cutler-Hammer v. General Electric Co., 6 F. [2d] 376, C. C. A., Bostock v. Goodrich, 21 F. 316, C. C. Pa., and other cases plaintiffs' main brief, pp. 136-7.) Affirmed

22. The technical defense that the patent in suit is not a joint invention of the three patentees, requires unquestionable proof from the defendants, and all doubts are to be resolved in favor of the patent. (Thropp v. DeLaski and other authorities, plaintiffs' reply brief, pp. 69-70; also Hall Signal v. Union, 115 F. 638, at 643, C. C., W. D., Pa., J. Buffington.) Affirmed

23. The invention of the patent is suit is a joint invention of the three patentees within the meaning of the statutes. (Thropp v. DeLaski, 226 F. 949, quoted at plaintiffs' reply brief, p. 70, and the testimony of Dr. Engl that the invention was made jointly by the three inventors working together in the same laboratory room; Tr., pp. 362; 299; 300; 345; the oaths of the Affirmed

three inventors filed in the application upon the filing of the original application, and again shortly prior to the issuance of the patent; the Film-Kurier article, Deft.s' Ex. 130, cited by defendants to prove lack of joint inventorship, is incompetent, but if it had any weight, it is offset by an article of Vogt's, 1926, D. Ex. 128. None of the inventors have testified that it was not a joint invention. See plaintiffs' main brief, pp. 39-40; reply brief, pp. 67-72).

Affirmed

24. Paragraph (a) of the disclaimer limits the patent in suit to apparatus wherein, and methods whereby sound is translated by light to or from a film strip moving uniformly past said light. The subject matter of said limitation is entirely consistent and in accordance with the teachings of the patent. The patent discloses translating the sound in that manner only and it was already claimed in several of the claims as issued; for example, see claims 9, 13 and 18 in suit.

Under paragraphs (b), (c) and (e), respectively, claims 9, 13, 18 and 19 are specifically limited to the feature of flywheel control. The subject matter of said limitation is entirely consistent and in accordance with the teachings of the patent which discloses such means of speed control, and this feature is claimed in several of the claims as issued; see for example claims 5 and 7 here at issue.

Under paragraph (d) of the disclaimer, claim 17 is limited to a sprocket forming a part of the carrier progressing means, and to its location with respect to a portion of the periphery of the cylinder already included in the claim. The subject matter of said limitation is entirely consistent and in accordance with the teachings of the patent which fully describes this arrangement; for example, in connection with Fig. 2 of the patent.

No part of the disclaimer broadens or purports to broaden the scope of any claim of the patent. (See plaintiffs' reply brief, pp. 23-32.)

25. Even if it be assumed (for discussion only) that the disclaimer to claim 17 adds another element or sub-element to the combination of the claim, such a disclaimer is nevertheless permissible and valid. (Hurlbut v. Schillinger, 130 U. S. 456, 32 L. Ed. 1011—see Tr. of argument, pp. 51-53; Strause v. Crane, 235 F. 126.) Affirmed

26. The presumption of validity of the patent in suit is unaffected by the disclaimer. (Carnegie Steel case, 185 U. S., at 435, and same case, C. C. A. 3rd, 89 F. at 738, 757; see other authorities, plaintiffs' main brief, p. 27, and reply brief, pp. 32-41.) Affirmed

27. The disclaimer is not a confession of anticipation in the absence of the disclaimer. (Nelson v. Meyers, 29 F. 2d 968, C. C. A.; Permutit v. Wadham, 13 F. 454, 457, C. C. A.; plaintiffs' reply brief, pp. 34-38.) Affirmed

28. In so far as the disclaimer may be considered unnecessary, it does no harm and does not prejudice the validity of the patent. (Cambria Steel case, supra, 185 U. S., at p. 436, Marconi v. DeForest, 243 F. 560, 565.) Affirmed

29. The claims in suit as modified by the disclaimer are valid. (See above authorities and plaintiffs' main brief, pp. 6, 27; plaintiffs' reply brief, pp. 32-41, including typical valid disclaimers there quoted.) Affirmed

30. The defense of invalidity under R. S., Sec. 4887 (here because of the German patent 387,058 to the same inventors) puts a heavy burden on the defendants which they have not overcome (General Electric Co. v. Affirmed

Alexander, 280 F. 852). Forfeitures are not favored in equity.

Affirmed

31. The apparatus of the German patent 387,058 being inoperative (see finding 70), the patent is impertinent under R. S., Sec. 4887. (General Electric Co. v. Alexander, supra; Aquarama v. Old Mill, 124 Fed. 229.)

Affirmed

32. The German patent 387,058 does not invalidate any of the claims at issue, under R. S., Sec. 4887, because there is no substantial identity of invention *claimed* in the foreign patent with that *claimed* in the claims at issue. For a foreign patent to invalidate a United States patent under this section, the invention claimed in the foreign patent must be substantially identical with the invention claimed by the claim or claims of the United States patent which it is sought to defeat. "It is not sufficient that the foreign patent may disclose the invention of the later United States patent where it is not therein claimed." (There are several features claimed in the claims at issue and shown in the United States patent, not even disclosed in the German patent. For differences, see finding of fact 70; authorities, Leeds & Catlin case, 213 U. S. 301; Fireball case, 239 U. S. 156; General Electric Co. v. Alexander, supra; Aquarama Co. v. Old Mill Co., et al., 124 F. 229; see plaintiffs' main brief, pp. 147-59; reply brief, pp. 75-83.)

Affirmed

33. The claims of the German patent 387,058 are for an apparatus and therefore, also for this reason, it does not patent the same invention as is patented by the method claims here at issue (9, 18 and 19). "A process" (method) "and apparatus by which it is performed are distinct things" . . . "Claims are independent inventions" and a claim for a method is for a different invention from that of a claim for the appa-

ratus by which the method is performed. (Leeds & Catlin case, 213 U. S. 301; Fireball case, 239 U. S. 156. The substantial legal distinction between methods and apparatus claims is evident from the fact that a U. S. method claim is not infringed by the manufacture of the apparatus by which the method may be performed —the apparatus may be made here and exported for use abroad notwithstanding any U. S. method claim covering its use.)

The German patent No. 387,058 was not a prior art patent with respect to the patent in suit because it was neither a patent (patented in Germany) nor a printed publication, prior to the filing of the application for the patent in suit. (R. S., Sec. 4886.)

34. That if said German patent No. 387,058 was operative and pertinent to the patent in suit under R. S., Sec. 4887, the patent in suit would be entitled to the priority date of said German patent under the Treaty of Berlin. (See plaintiffs' main and reply briefs In Re Berlin Treaty.) Refused

35. The grant of a patent carries with it the presumption of validity and the burden of proof to establish anticipation or lack of invention rests heavily upon a defendant attacking the patent, and the evidence must be very clear and convincing, if indeed every reasonable doubt should not be resolved against him. (Window Glass Mach. Co. v. Smethport Window Glass Co. [W. D., Pa.], 266 F. 85, at p. 93; Ward Baking Co. v. Hazleton Baking Co., 292 F. 202 [M. D., Pa.], at p. 204; T. B. Woods Sons Co. v. Valley Iron Works [M. D., Pa.], 191 F. R. 196, at 200, affirmed 196 F. 780, C. C. A. 3d; Carnegie Steel Co. v. Cambria Iron Co. [W. D., Pa.], 89 F. 721, at p. 738; Charnbury v. Walden [C. C. D., N. J.], 141 F. 373, at p. 377; Massie v. Fruit Growers Express Co. [D. C., Del.], 31 F. [2d] 463, at p. 464.) Defendants have failed to overcome this burden. Affirmed

Affirmed 36. That the inventions of the claims at issue are novel and patentable; that claims 5, 7, 9, 13, 18 and 19 are infringed by defendants' PS1 apparatus as charged, and claims 9, 13, 17, 18 and 19 are infringed by defendants' PS16 apparatus as charged.

Affirmed 37. Title to the patent in suit and license rights thereunder rests in the plaintiffs, American Tri-Ergon Corporation and Tri-Ergon Holding, A. G., as pleaded.

Affirmed 38. Plaintiffs are entitled to injunctions restraining the defendants from further infringements, and for accountings and costs, as prayed for in the two bills of complaint.

Respectfully submitted,

KAUFMAN & MATTES,
Solicitors for Plaintiffs.

Of Counsel:
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PAGE S. HASELTON.

ORDER.

The above answers are made and the requests with answers are ordered filed this twenty-fourth day of November, 1933.

ALBERT W. JOHNSON,
U. S. District Judge.

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DEFENDANTS' PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW.

I. Parties, Patent in Suit, Title, Defendants' Apparatus, and Claims Relied Upon.

Findings of Fact:

1. Plaintiff, American Tri-Ergon Corporation, is the owner of the patent in suit No. 1,713,726 (Assignment, P. Ex. 14-E), and plaintiff, Tri-Ergon Holding, A. G., has certain license rights thereunder (Bills of Complaint, Par. 3(c)). Affirmed

2. Altoona Publix Theatres, Inc., the sole defendant in suit No. 971, operates the Grand Theatre at Huntingdon, Pa., in which the alleged infringing apparatus Type PS-16 is installed (Tr. 156, 7). Wilmer & Vincent Corporation, one of the defendants in suit No. 972, operates the State Theatre at Harrisburg, Pa., in which the alleged infringing apparatus Type PS-1 is installed (Tr. 155). Locust Street Real Estate Company, the other defendant in the last-named suit, owns the State Theatre (Tr. 155). Affirmed

3. Both suits are defended by R. C. A. Photophone, Inc., the talking motion picture subsidiary of the Radio Corporation of America (Tr. 157). R. C. A. Photophone, Inc., leased the alleged infringing equipment Type PS-16 to the defendant, Altoona Publix Theatres, Inc., and the alleged infringing equipment Type PS-1 to the Locust Street Real Estate Company (Tr. 157). Affirmed

4. The patentees of the patent in suit are three Germans, Vogt, Massolle and Engl, who filed the application for the patent in suit in the United States Patent Office on March 20, 1922 (P. Ex. 1). Affirmed

Affirmed

5. Claims 5, 7, 9, 13, 17, 18 and 19 of the patent are in suit. Claims 9, 13, 18 and 19 are relied upon as to both types of defendants' apparatus; claims 5 and 7 are relied upon as to Type PS-1 only; and claim 17 is relied upon as to Type PS-16 only (Defts.' Main Brief, p. 39).

II. The Alleged Invention.

Findings of Fact:

Refused as put

6. The patent in suit is commonly designated by the patent owners, as well as by others, as "the flywheel patent" (Defts.' Main Brief, p. 3; D. Ex. 127). The patent has been so named because it relates to a ribbon or film phonograph in which the predominant feature or gist of the alleged invention is in the use of a flywheel for assisting in obtaining uniformity of motion of parts of the phonograph (Defts.' Main Brief, pp. 3, 17-19; Defts.' Reply Brief, pp. 9, 10).

Affirmed

7. The claims do not include motion pictures but are for phonographic apparatus and phonographic methods whether or not used in connection with motion pictures (Appendix to Defts.' Brief, pp. 1-6).

III. Flywheel Principles, and Prior Knowledge and Use of Flywheels.

Findings of Fact:

Affirmed

8. As stated in one of plaintiffs' own exhibits, "A flywheel is the *classical* and unexcelled means of obtaining *uniform rotation*" (P. Ex. 44, p. 658; Defts.' Main Brief, p. 4). The flywheel has been the everyday tool of the mechanic for a great many years (Defts.' Main Brief, p. 4).

Affirmed

9. Absolute uniform motion is an unattainable ideal (Tr. 1306). The degree to which uniformity is

approached depends on the care exercised by the builder of the machine. Each machine designer determines the degree of uniformity required in practice in each particular machine and he then designs the machine to give that degree of uniformity. The difference in the uniformity of one machine compared with that of another machine is at most merely a matter of degree (Tr. p. 1308). (Defts.' Main Brief, pp. 4-5).

10. All rotating parts, whether or not made in the conventional form of a flywheel, have momentum and, therefore, all such parts tend to maintain uniform or constant speed (Tr. 1307). The conventional form of a flywheel is a wheel with a heavy rim (D. Ex. 71, p. 409). But a flywheel is still a flywheel even though it be in the form of a gear, or pulley (Tr. 1310-11). The terms "balance wheel", "momentum wheel", and "flywheel" are synonymous (Tr. 1307). (Defts.' Main Brief, p. 5). Affirmed

11. As found by the Supreme Court nearly forty years ago in *American Road Machine Co. v. Pennock & Sharp Co.,* 164 U. S. 26, pages 34 and 39: Affirmed

> "The knowledge was common that when a continuous power is applied, but the resistance to be overcome is unequal, a fly or balance-wheel will store some of the power expended during the operation and not needed at one stage, and give it out at another. . . .
>
> "The law of nature was familiarly understood that any moving body tends to continue in motion with a force proportionate to its speed and weight; and it was well known that the function of flywheels and balance-wheels was, in the language of Mr. Brevoort, 'to absorb energy when the machine is moving at greater speed with the least resistance, and to give it out again when the parts meet with greater resistance.'" (Defts.' Main Brief, pp. 6-7).

Therefore, what a flywheel always does is to store up energy when its speed is increased and give up energy when its speed is decreased (Tr. 1307). If the resistance to motion decreases so that the shaft starts to speed up, the flywheel absorbs the energy and resists and minimizes the increase of speed; and if the resistance to motion of the shaft increases so that it starts to slow down, the flywheel gives out its stored energy and resists and minimizes the decrease in speed. (Defts.' Main Brief, p. 5).

Affirmed

12. The principles relating to uniform motion and its attainment by the use of a rotating heavy mass or flywheel were not only thoroughly understood many years ago but their application had become merely a routine matter of mathematics in machine design (Tr. p. 1308). The principles were so well known that they appeared in textbooks (D. Ex. 71) and in a decision of the Supreme Court many years before any date important here (*supra*). (Defts.' Main Brief, pp. 5-7).

Affirmed

13. There is an almost unlimited number of prior analogous uses of flywheels for giving constant speed in various types of machines but flywheels were also used for that purpose in the phonographic art from the beginning of that art. (Defts.' Main Brief, p. 8).

IV. The Patent in Suit Is Anticipated by and Also Lacked Intention Over the Prior Art.

Findings of Fact:

Affirmed

14. Edison was the father of the phonograph and also the father of the motion picture as known today. Edison applied for his patent No. 227,679 (D. Ex. 74, Item 3) in 1879, in which he disclosed a large flywheel, mounted directly on the shaft which carried the sound record so that the flywheel controlled the speed of the

sound record directly at the point at which the sound was recorded and from which it was reproduced, *i. e.*, the translating point. It appears from this Edison patent that as early as 1879 Edison fully understood the principles of uniform motion and that uniform motion could be obtained in a phonograph by means of a flywheel. Notwithstanding he was the first to use a flywheel in a phonograph, Edison's claim for this use of a flywheel was rejected by the Patent Office as being "a mere double use of a flywheel as ordinarily used with machinery for the purpose of securing uniformity of motion" (D. Ex. 73, p. 15) and, because it "involved but the exercise of ordinary good judgment and did not require invention" (D. Ex. 73, p. 17). (Defts.' Main Brief, pp. 9-12).

15. Edison used heavy flywheels in his commercial phonographs as early as 1878, as appears from the Edison instruction book (D. Ex. 120-B), an original of which is in the Smithsonian Institution. On page 3 of that book the phonograph with its heavy flywheel mounted directly on the mandrel shaft is shown, and it is stated, "Heavy flywheel, to give uniform motion (Very important)". Flywheels for obtaining uniform motion in Edison phonographs are also disclosed in Edison patents Nos. 386,974 of 1888, 499,879 of 1893 and 513,095 of 1894 (D. Ex. 74, Items 7, 8, 9). From 1879, when Edison stated and applied the principles of uniform motion to the phonograph, until the present time those principles have been employed in all phonographs. One or more rotating heavy masses have been employed without exception, the size of the mass being determined by the degree of speed constancy desired in each particular machine. (Defts.' Main Brief, pp. 13-16). Affirmed

16. In recording commercial phonograph records for home use, Edison exercised particular care that Affirmed

they should be recorded with a high degree of uniformity. Defendants' Exhibits 31 and 155 are two original Edison machines which were used at the Edison recording laboratory in New York considerably before 1921 for recording Edison commercial phonograph records. Each of these machines has a heavy flywheel directly and rigidly mounted on the record mandrel shaft. These flywheels produce a high degree of speed constancy as was shown by defendants' demonstration during the trial. (Defts.' Main Brief, pp. 15, 16, 85, 86).

Refused as put

17. The early Edison machines employed cylindrical records. Many thousands of disc record phonographs were also in use before 1921. The Victrola (D. Ex. 39) is typical of the disc phonographs in which a high degree of uniform speed was provided by means of a heavy flywheel-turntable on which the disc record is supported (Defts.' Main Brief, p. 15). Edison was only one of a large number of persons who used heavy flywheels for obtaining uniform motion in the phonograph art. Others are Gally, 210,249, flywheel E; Bell *et al.*, 341,213, flywheel 8; Tainter, 341,288, flywheel 317; Berliner, 534,543, flywheel 77, and flywheel-turntable 4; Clark, 597,875, flywheel D^1; Jones, 602,453, flywheel B; Jones, 605,484, flywheel-turntable B; Amet, 1,065,576, flywheel 8; Amet, 1,162,433 and 1,221,407, flywheel 32; Ebeling, 1,255,143, flywheel-turntable 31; Clark, 1,367,863 and 1,388,515, flywheel-turntable 36; and French patent 414,788, flywheel-turntables *j* provided with heavy rims (D. Ex. 74). Every one of these prior patentees utilized a flywheel for exactly the same purpose as the flywheel of the patent in suit. The means, mode of operation and result were the same in each case. (Defts.' Main Brief, p. 87).

18. Being the father of both phonographs and motion pictures it was natural that Edison should be the first to introduce to the public the combination of the earlier forms of entertainment, that is, the talking motion picture. The Edison talking picture was introduced as early as 1912, the phonograph being operated in synchronism with the motion picture machine. The Edison talking pictures were favorably received by the public and no doubt would still be in use today had they not been withdrawn from the market by the Edison Company as a result of the fire which destroyed the Edison plant in 1914 (Tr. 759). The Edison talking pictures were very satisfactory for small auditoriums and theatres where large volumes of sound were not required. They were unable to produce large volumes of sound because the electrical devices by which large volume has since been obtained had not been developed. (Defts.' Main Brief, pp. 12-13.) Refused as put

The Edison talking picture recording machines (Drawings, D. Exs. 17-19-LLL) and the reproducing machines (D. Ex. 11), which were used in recording and reproducing the Edison talking motion pictures, were provided with heavy flywheels on their record mandrel shafts insuring speed constancy. (Defts.' Main Brief, pp. 16, 83, 84.) An illustration of the successful exhibition of the Edison talking pictures is the exhibition of the Watson talking picture "The Birth of the Telephone" at the Panama Pacific Exposition in San Francisco from April to December 1915, and the subsequent exhibition of this and other Edison talking pictures in many parts of the United States until as late as 1917. (Defts.' Main Brief, p. 85.) A high degree of uniform speed was attained by means of the heavy flywheel used in the Edison talking picture machines, as was demonstrated by the defendants at the trial. (Defts.' Main Brief, pp. 84-85; Defts.' Reply Brief, pp. 14, 15.)

Sound, no matter by what specific means it is recorded or reproduced, must be recorded and reproduced at a uniform speed in order to avoid distortion of the sound.

None of the Edison phonographs or the other prior art phonographs relied upon in this case can, so far as concerns uniform motion, be distinguished from the patent in suit on the ground that in some of them sound was recorded and reproduced by means of a stylus, or because in some of them wax or composition records were used in place of a photographic film. This was conclusively demonstrated by the defendants at the trial. (Defts.' Main Brief, pp. 84, 86; Defts.' Reply Brief, pp. 14, 15.)

Refused as put

19. Talking motion pictures were, therefore, known and used considerably before the patentees of the patent in suit began their work in 1918 or 1919. Sound-on-film recording and reproducing machines, as well as sound-on-disc and sound-on-cylinder machines, were also old. This is admitted on the face of the patent in suit where the prior machines are referred to (P. Ex. 1, p. 1). Furthermore, as held by the Nullity Department of the German Patent Office in one of the patentees' own cases, a complete sound-on-film talking picture system was disclosed as early as 1906 in the prior British patent to Haines 18,057 (D. Ex. 136; Defts.' Reply Brief, p. 10; Appendix to Defts.' Brief, pp. 43, 44). The patentees merely took the old system bodily from the prior art, and, when they filed their application for the patent in suit, the only alleged invention which they even represented they had made was the addition of a flywheel to that old system (Defts.' Main Brief, pp. 17-19). The old system was not changed or modified in any patentable way by that addition (Defts.' Reply Brief, p. 10), nor was that addition new.

20. Sound-on-film was not merely old but was well known (Defts.' Reply Brief, p. 10). Pedersen in his British patent No. 115,942 of 1918 (D. Ex. 74, Item 42) also shows and describes recording sound photographically by means of light along the margin of a motion picture film beside the pictures (Defts.' Main Brief, pp. 53-55). The same is true of the prior Ries patents Nos. 1,473,976 and 1,607,480, applied for in 1913 (D. Ex. 74, Items 29 and 30) and the Haines patent, *supra*. Sound was also recorded photographically on a film at the General Electric Company by Story at least as early as February 1, 1916 (Defts.' Main Brief, p. 73), and also by Hoxie prior to the date of the alleged invention of the patent in suit (Defts.' Main Brief, pp. 75, 76). Refused as put

21. In order to record the sound photographically by means of light on the margin of the film at uniform speed, Pedersen employed a particularly large flywheel (D. Ex. 74, Item 42, p. 2, ll. 29-32; Defts.' Main Brief, p. 54). It is clear from Pedersen's specification that Pedersen intended his large flywheel to be mounted directly on the film sprocket shaft because he says that the "recording of the sound waves should be done at a position where the film receives uniform motion, for example on the delivery drum or feed reel" (*id.*, p. 2, ll. 22-24); that the reproduction should take place on the "uniformly rotating transmitting drum" (*id.*, p. 2, l. 25); and that this drum in both recording and reproducing is "moved at constant velocity" (*id.*, p. 2, l. 50 and p. 3, l. 6). (Defts.' Main Brief, p. 54.) Refused as put

22. The Dragoumis patent No. 472,467 (D. Ex. 74, Item 46) of 1914 also discloses a flywheel mounted directly on the mandrel shaft at the point at which the sound is recorded and at which it is reproduced from the film (Defts.' Main Brief, pp. 55, 62; Defts.' Refused

Reply Brief, pp. 18, 19). That the flywheel is not described in Dragoumis' specifications is immaterial it being such in fact, as the Supreme Court held in the *American Road Machine Case, supra,* (Defts.' Main Brief, p. 61). Furthermore, defendants demonstrated at the trial by means of their model (D. Ex. 86), made in accordance with the drawings of the Dragoumis patent, that the Dragoumis flywheel performed exactly the same function as the flywheel of the patent in suit and gave excellent speed performance (Defts.' Main Brief, p. 59). Even if Dragoumis had intended only a very light wheel, which would not have been sufficient to give reasonably good speed constancy, still the substitution of a heavier wheel for a lighter one did not involve invention, as the Supreme Court also held in the same case (Defts.' Main Brief, pp. 61, 62).

Refused as put

23. In his application (D. Ex. 95), filed January 8, 1921, which is prior to the earliest date (March 24, 1921) to which the patentees of the patent in suit are entitled, Cawley disclosed a large and massive flywheel for giving uniform motion to the film at the point of translation (Defts.' Main Brief, p. 63). This Cawley application also discloses the recording and reproduction of the sound at the point of translation by means of light as in the patent in suit (See Cawley patents Nos. 1,825,438 to 1,825,441, D. Ex. 74, Items 32-35, which are based on this Cawley application, and Defts.' Main Brief, p. 63). Also, in his application of October 3, 1919 (D. Ex. 94) Cawley disclosed a flywheel for moving the film, recorded and reproduced by means of a stylus, at uniform speed at the point of translation (See Cawley patents Nos. 1,710,677 and 1,878,577 based upon this 1919 application, D. Ex. 74, Items 31 and 36; and Defts.' Main Brief, p. 64). (See Conclusion 42, *infra,* p. 1119.)

24. Bell and Tainter disclosed in Fig. 18 of patent No. 341,214 of 1886 (D. Ex. 74, Item 5) a ribbon phonograph in which the large flywheel H causes the sound record, in the form of a wax-coated paper strip, to move at uniform speed while the sound is recorded and reproduced by a stylus. (Defts.' Main Brief, p. 65.) In their other patent No. 341,213 of the same date (D. Ex. 74, Item 4), Bell and Tainter recorded the sound photographically by means of an optical slit on a photographic plate rotated at uniform speed under control of the heavy flywheel 8 (Defts.' Main Brief, p. 66). Neither the Bell and Tainter patents nor any of the other prior art relied upon in this case can be distinguished from the patent in suit on the ground that a friction pinion or a gear or gears intervene between the flywheel and the sound record. The patentees of the patent in suit admitted during the prosecution of their application that many "objects and advantages of the invention would not be defeated, even if the flywheel were connected through properly constructed gearing, etc." (P. Ex. 1, pp. 73, 74; Defts.' Reply Brief, pp. 15, 16.)

Refused as too broadly stated

25. On December 12, 1920, Hoxie of the General Electric Company made his sketch (D. Ex. 50) disclosing the elements of a complete sound recording and reproducing system in which the sound is recorded on film photographically by means of a narrow line of light, produced by a slit and optical system. And the sound is reproduced from the film by the same means and a photoelectric cell, so named in the sketch (Defts.' Main Brief, p. 74). As soon as this sketch was made and in January, 1920, Hoxie had built the sound-on-film recording and reproducing machine (D. Ex. 43), referred to as the first General Electric machine. The machine was completed in January, 1921. It consisted of the box containing at the top a supply reel for the

Refused as put

film and at the bottom a take-up reel and a very narrow slit past which the film was caused to travel, the film being held close to the slit by means of small springs. The film was driven by a sprocket on whose shaft was directly mounted a large flywheel identical with the flywheel on D. Ex. 44. The machine was first operated by hand but a motor drive like D. Ex. 44 was applied almost immediately and in January, 1921. A belt was run from the pulley on the motor shaft around a groove cut in the periphery of the flywheel. While the machine was in this condition with the flywheel on it, the record, known as No. 25 (D. Ex. 51), was recorded and reproduced on the machine on March 8, 1921, which is more than two weeks prior to the earliest date, March 24, 1921, to which the patentees of the patent in suit are entitled. The record (D. Ex. 51) has recorded on it a clear description of how the sound was recorded on the machine (D. Ex. 43) and also how it was reproduced by means of a photoelectric cell and vacuum tube amplifier. The record itself states that the photographic film "moves past the point [translating point] at a uniform rate of speed" and also that "this record was made March 8, 1921". The date, March 9, 1921, was written on the film at each end on March 9, 1921, the day after the record was made and reproduced. That the record was recorded and reproduced at uniform speed on the machine (D. Ex. 43) by means of the flywheel was conclusively demonstrated at the trial by the reproduction of the original film (D. Ex. 51) on the second General Electric machine referred to in finding 26, *infra* (Defts.' Main Brief, pp. 74-78). (See Conclusion 43, *infra*, p. 1119.)

Refused as put

26. Work on the second General Electric machine (D. Ex. 45) was begun on February 10, 1921, and was continuous until the machine was completed. The latest that the machine could have been completed was

April 16, 1921, which is the date of the last entry in the time book of the witness Tschopp (D. Ex. 48; Defts.' Main Brief, pp. 78-80). In this machine (D. Ex. 45) the sound was reproduced from the film by means of a narrow line of light, produced by a slit and optical system, a photo-electric cell and amplifier. The film was driven by an electric motor through a belt which passed around a pulley fastened to the outside face of a flywheel. The flywheel was mounted directly on the same shaft as the toothed cylinder or sprocket which propelled the film. The periphery of the flywheel was provided with gear teeth so as to drive through a small worm pinion the centrifugal governor. The uniform speed obtained with this machine, as was demonstrated by the defendants at the trial, was due to the flywheel effect of the flywheel and governor (Defts.' Main Brief, pp. 78-81). (See Conclusion 44, *infra*, p. 1119.)

27. Trowbridge and Duryea patent No. 1,447,913 (D. Ex. 74, Item 28), applied for in October, 1920, and the original machine (D. Ex. 36), which is identical with that shown in the patent and was built in 1919, disclose and employ, respectively, a source of light and optical slit, including the slit 66-67 and cylindrical lens 64, by which the light is reduced to a very fine line which impinges on the photographic tape. The photographic tape is fed from a reel through a spring-pressed gate to two smooth cylinders by which it is moved through the machine at uniform speed, one of the rollers being driven at uniform speed by means of a flywheel mounted directly on the same shaft as the roller and in exactly the same position as the flywheel in the patent in suit (Defts.' Main Brief, pp. 81-83). Refused as put

28. Flexing or arcuate bending of the film, and passing the film over a substantial portion of the periphery of a cylinder or sprocket, and at the point of Refused, too broad

translation, is disclosed in combination with a flywheel in the prior patent to Pedersen No. 115,942 (D. Ex. 74, Item 42; Defts.' Main Brief, p. 55; Defts.' Reply Brief, pp. 17, 18), in the original application (D. Ex. 95) on which the Cawley patents Nos. 1,825,438 to 1,825,441 (D. Ex. 74, Items 32-35; Defts.' Main Brief, p. 63) are based, in the original application (D. Ex. 94) on which Cawley patents Nos. 1,710,677 and 1,878,577 (D. Ex. 74, Items 31 and 36; Defts.' Main Brief, p. 64) are based, and in the Bell and Tainter patent No. 341,214 (D. Ex. 74, Item 5; Defts.' Main Brief, p. 65; Defts.' Reply Brief, p. 16). It is also shown in combination with a flywheel in Holst patent No. 587,527 (D. Ex. 74, Item 12; Defts.' Main Brief, pp. 90, 102). The film is also flexed at the point of translation in the Edison British patent 1644 (See Fig. 57; D. Ex. 74, Item 37; Defts.' Main Brief, p. 102), and in numerous other patents relied upon in this case (Tr. 1377-8). And the film was wrapped around the sprocket on the flywheel shaft in both General Electric machines (D. Exs. 43, 45; Defts.' Main Brief, 75, 79). Furthermore, curved film gates such as used in the defendants' machines at the point of translation are disclosed in numerous prior art patents, typical examples being Terwilliger No. 1,256,613 (curved gate 71, Fig. 3; D. Ex. 75, Item 14) and Andersen patent No. 1,246,217 (curved gate 5, Fig. 1, D. Ex. 75, Item 13; Defts.' Main Brief, p. 123).

Affirmed

29. Optical slits are disclosed in Bell and Tainter patent No. 341,213 of 1886 (D. Ex. 74, Item 4; Defts.' Main Brief, p. 66; see Fig. 1, and p. 1, ll. 61-69, p. 2, ll. 68-88); Duddell patent No. 24,546 of 1902 (D. Ex. 74, Item 40; see p. 3, ll. 22-40; Abstract of Argument for Defts. p. 40); in the application for Trowbridge patent No. 1,447,913 (D. Ex. 74, Item 28), filed in 1920, in the Trowbridge machine of 1919 (Defts.' Main

Brief, p. 82); and in the article by Rankine in the "Proceedings of the Physical Society of London" of 1920 (D. Ex. 74, Item 48; Defts.' Main Brief, p. 23). Moreover, Bell and Tainter not only disclosed but also received in their above mentioned patent which issued in 1886 the following combination claim, including the optical slit and mechanism (the flywheel) for giving uniform motion to the photographic tablet:

> "The apparatus for recording sound vibrations photographically, consisting of the following elements in combination, namely: *the condensing-lens, the plate or block provided with a slit,* the means for varying the quantity or intensity of the energy transmitted through said slit, the recording-tablet, *the lens for projecting an image of the slit on the tablet, and the mechanism for giving a uniform surface-speed to the tablet under said image, substantially as described.*"

30. A damped-spring phonograph drive is shown in the prior Constable patent No. 1,425,177 (D. Ex. 74, Item 27; Defts.' Main Brief, p. 93) and an inherently damped resilient phonograph drive is shown in combination with a flywheel in Amet patent No. 1,221,407 (D. Ex. 74, Item 22; Defts.' Main Brief, p. 93). Other exampies of resilient drives in combination with a flywheel are: Gally, 210,249; Holst, 587,527; Wood, 724,-645; Ebeling, 1,255,143; Lanchester, 1,085,443; Rowland, 691,667; Jamieson British 2,814; Baron British 21,371; French patent 414,788; and French patent of Addition 10,377 (See D. Exs. 74 and 75; and Defts.' Main Brief, p. 94). Affirmed

31. A flexible belt, such as used in the First and Second General Electric Machines (D. Exs. 43 and 45), in the Edison talking picture recording and reproducing machines (Drawings D. Ex. 17-19-LLL; D. Ex. 11) and in the Edison commercial phonograph recording Refused as put

machines (D. Exs. 31, 155), is the equivalent of a spring drive, but is vastly superior to an undamped spring as disclosed in Figs. 5 and 6 of the patent in suit, because a flexible belt is inherently damped (Defts.' Main Brief, p. 92).

Refused as put

32. The patentees of the patent in suit were not the first to suggest or use the photoelectric cell for reproducing sound from film. The photoelectric cell was used by Story at the General Electric Company at least as early as February, 1916 for reproducing sound from film (Defts.' Main Brief, p. 73.) The use of the photoelectric cell for reproducing sound from film was also fully disclosed by Hoxie in his sketch (D. Ex. 50), made on December 12, 1920, and the photoelectric cell was used by him for the same purpose on March 8, 1921 for reproducing the film (D. Ex. 51), which is earlier than the earliest date to which the patentees of the patent in suit are entitled (Defts.' Main Brief, pp. 74-76). The use of the photoelectric cell for reproducing sound from film is also disclosed in Duddell patent No. 24,546 of 1902 (D. Ex. 74, Item 40; p. 4, l. 33). Photoelectric cells were known as early as 1890, as appears from the article by Elster and Geitel (D. Ex. 139), and are also disclosed in the prior patents to Langmuir No. 1,273,627, applied for in 1914 (D. Ex. 75, Item 17); Compton No. 1,567,424 (*id.*, Item 21); and Hull No. 1,313,187 (D. Ex. 41). (Defts' Main Brief, p. 73).

Refused as put

33. Flywheels have been universally used since the earliest days of the motion picture to provide uniform motion in motion picture projectors (Defts.' Main Brief, pp. 87-98). In the continuous type of motion picture projectors, typical of which are the continuous projectors shown in the prior Holst patent No. 587,527 (D. Ex. 74, Item 12) and the Momyer patent

No. 1,317,450 (D. Ex. 75, Item 18), heavy flywheels, mounted directly on the film feeding sprocket shaft, were used and caused the film to be moved at uniform speed (Defts.' Main Brief, p. 90). In the intermittent projectors, typical of which is the Powers projector (Machine, D. Ex. 8, and catalogue D. Ex. 6), the flywheel is located directly on the constantly rotating shaft of the intermittent movement and causes that shaft to rotate at uniform speed. Other examples of intermittent projectors having flywheels mounted directly on the constantly rotating shaft of the intermittent movement are the Edison projector or Kinetoscope (Machine, D. Ex. 12, and catalogue, D. Ex. 10); the Simplex projector (Machines, D. Exs. 1 and 5, catalogue, D. Ex. 2); and the German or Ernemann projector, (Machine, D. Ex. 28, and sketches, D. Exs. 133 and 134). An intermittent projector with flywheel is also shown in the prior Blair patent No. 1,186,069, flywheel 48 (D. Ex. 75, Item 11). (Defts.' Main Brief, pp. 88-90).

V. Conclusions of Law Based on the Prior Art.

34. Claims 5, 7, 9, 13, 17, 18 and 19, the claims in suit, are anticipated by the prior art and are, therefore, invalid. Refused

35. Claims 5, 7, 9, 13, 17, 18 and 19, the claims in suit, also lack invention over the prior art and are, therefore, invalid. (Authorities, Defts.' Main Brief, pp. 5-8, 25, 26, 38, 61, 62, 90-92, 142.) Refused

36. Claims 5, 7, 9, 13, 17, 18 and 19, the claims in suit, are for aggregations of old and well known elements and not patentable combinations and are, therefore, invalid. (Authorities, Defts.' Reply Brief, p. 12.) Refused

37. There was no invention in assembling the old elements of the claims in suit but at most merely a Refused

judicious selection of those elements from the prior art (Authorities, Defts.' Reply Brief, p. 12).

Refused

38. No new function or result was brought about by the assembling of the old elements of the claims in suit. Those elements accomplished at most no more than an aggregate of the old results obtained by the separate elements. (Authorities, Defts.' Reply Brief, p. 12.)

Refused

39. If any increase in the uniformity of speed of the film was obtained by the alleged invention of the patent in suit, it was merely a difference in degree which is not invention (Authorities, Defts.' Main Brief, pp. 4, 5; Defts.' Reply Brief, p. 13).

Refused

40. The use of a flywheel in a ribbon or film phonograph was merely an analogous or double use of flywheels as used in cylinder and disc phonographs and motion picture projectors and did not constitute invention (Authorities, Defts.' Main Brief, pp. 91, 92).

Refused

41. Public use and knowledge, prior to the earliest date to which the patentees of the patent in suit are entitled, of the Edison talking picture recording machine (Drawings, D. Exs. 17-19-LLL; Defts.' Main Brief, pp. 83-85), the Edison talking picture reproducing machine (D. Ex. 11; Defts.' Main Brief, pp. 83-85), the Edison commercial recording machines (D. Exs. 31, 155; Defts.' Main Brief, pp. 85, 86), the Trowbridge machine (D. Ex. 36; Defts.' Main Brief, pp. 81-83), the first General Electric machine (D. Ex. 43, Defts.' Main Brief, pp. 74, 75; Defts.' Reply Brief, pp. 20-24), and the Hoxie film (D. Ex. 51), and prior invention by Hoxie of the second General Electric machine (D. Ex. 45), are fully established by defendants' proofs (Authorities, Defts.' Reply Brief, pp. 20-24).

42. Having filed his applications (D. Exs. 94, 95) for the same alleged invention as the patent in suit prior to the earliest date to which the patentees of the patent in suit are entitled, Cawley is the prior inventor and the patent in suit is, therefore, invalid (*Milburn Co.* v. *Davis-Bournonville,* 270 U. S. 390). (See Finding 23, *supra,* p. 1110.) Refused

43. The General Electric recorder and reproducer (D. Ex. 43) as used to record and reproduce sound prior to March 24, 1921, the earliest date to which the patentees of the patent in suit are entitled, constitutes prior knowledge and use of the alleged invention of the patent in suit under Section 4920 of the Revised Statutes and, therefore, the patent in suit is invalid (Defts.' Main Brief, p. 77). (See Finding 25, *supra,* p. 1112.) Refused

44. The machine (D. Ex. 45) having been conceived by Hoxie prior to the patentees' date of March 24, 1921, and work on it having been begun before February 10, 1921 and continued without interruption until the machine was completed and operated in March, 1921 or by April 16, 1921 at the latest, it is established that Hoxie was the prior inventor of the alleged invention of the patent in suit. *Automatic Weighing Machine Co.* v. *Pneumatic Scale Corp.,* 166 Fed. 288 (Defts.' Main Brief, p. 80). Therefore, the patent in suit is invalid. (See Finding 26, *supra,* p. 1113.) Refused

45. As held by the Nullity Department of the German Patent Office, it did not involve invention to employ a spring drive with a flywheel in a phonograph to produce uniform speed of a sound record, as claimed in Claim 7 (D. Ex. 101; Defts.' Main Brief, p. 97). Refused

46. As held in the two nullity proceedings of the German Patent Office (D. Exs. 113-A and B; Defts.' Refused

Main Brief, pp. 71-73; Appendix to Defts.' Brief, p. 40), invention was not involved in the use of a photoelectric cell in place of the selenium cell for the reproduction of sound from film, as claimed in claim 13.

VI. Defense Under Section 4887 of the Revised Statutes.

Findings of Fact:

Refused as put

47. German patent No. 387,058 was granted to the patentees of the patent in suit on December 27, 1923, which was prior to the grant on May 21, 1929 of the patent in suit, and was based on an application filed in Germany on May 23, 1920, which was more than 12 months prior to the filing on March 20, 1922 of the application for the patent in suit (Defts.' Main Brief, pp. 99, 100).

Refused

48. German patent No. 387,058 is for the same alleged invention as the patent in suit (Defts.' Main Brief, pp. 100-113; Defts.' Reply Brief, pp. 32-35).

Refused

49. The plaintiffs and the patentees of the patent in suit have admitted that German patent No. 387,058 is for the same alleged invention as the patent in suit (Defts.' Main Brief, pp. 105, 106).

Refused

50. German patent No. 387,058 is operative. Its operativeness was demonstrated by the defendants at the trial (Defts.' Main Brief, pp. 104, 105; Defts.' Reply Brief, pp. 25, 32).

Conclusions of Law:

Refused as put

51. The earliest date to which the patentees of the patent in suit are entitled under Revised Statute 4887 is March 24, 1921, the date on which they filed in Germany their application for German patent of addition No. 389,318 (D. Ex. 108; Defts.' Main Brief, p.

16; Defts.' Reply Brief, p. 25; Defts.' Memo. on the Treaty of Berlin, pp. 2, 9-15).

52. The Treaty of Berlin did not give the patentees the right to carry the effective date of the application for the patent in suit (*i. e.*, March 24, 1921) back to the filing date of the main German patent No. 387,058 (*i. e.*, May 23, 1920). Affirmed

53. The Treaty of Berlin did not confer on German inventors any additional priority rights over and above those conferred by the Nolan Act (35 U. S. C. 80; Defts.' Memo. on the Treaty of Berlin, pp. 4-6). Affirmed

54. Even if the Treaty of Berlin should be construed as contemplating additional priority rights for German inventors, nevertheless such construction rests upon the adoption by the Treaty of Berlin of Section 308 of the Treaty of Versailles, which section was not self-executing and no supporting legislation has ever been enacted in aid thereof (Defts.' Memo. on The Treaty of Berlin, pp. 5-8). Affirmed

55. Even if the Treaty of Berlin were effective in conferring additional priority rights, nevertheless the patentees of the patent in suit could not avail themselves of such rights because they dealt with the application for the patent in suit as hostile to and independent of the application for the main German patent No. 387,058. From 1922, when the application for the patent in suit was filed, until the patent in suit issued in 1929 and thereafter during the remaining four years until the trial of the present case, the patentees never claimed the benefit of the application date of the main German patent No. 387,058 (Defts.' Memo. on Treaty of Berlin, pp. 9-15). Refused as put

Refused 56. The patent in suit is invalid under Section 4887 of the Revised Statutes because of the prior grant to the patentees of the main German patent No. 387,058 for the same alleged invention (Authorities, Defts.' Main Brief, pp. 109-113; Defts.' Reply Brief, pp. 32-34).

VII. Defense of Lack of Joint Inventorship.

Findings of Fact:

Refused 57. All three of the patentees did not make or contribute to the alleged invention of the patent in suit (Defts.' Main Brief, pp. 125-141).

Refused 58. The patentees of the patent in suit were not familiar with the patent laws of the United States and believed that those who owned or were in possession of an alleged invention could apply for a United States patent even though they were not the true inventors (Defts.' Main Brief, pp. 137-141).

Conclusion of Law:

Refused 59. The patent in suit is invalid because the alleged invention was not a joint invention of the three patentees (Authorities; Defts.' Main Brief, pp. 125, 134, 138-141).

VIII. Defense That the Claims in Suit Are Invalid in View of the Disclaimer.

Findings of Fact:

Refused 60. By the disclaimer executed only twelve days before the trial plaintiffs improperly rewrote and amended the claims in suit in an attempt to avoid the prior art and also to make them read on defendants' machines. The disclaimer was not filed until the defendants had furnished plaintiffs with complete infor-

mation as to the construction of defendants' machines and the prior art relied upon (Defts.' Main Brief pp. 41-46; Appendix to Defts.' Briefs, pp. 1-6).

61. Each of the claims was amended by the disclaimer to include one or more additional elements (Defts.' Main Brief, pp. 43-46; Appendix to Defts.' Briefs, pp. 1-6). Refused

Conclusions of Law:

62. The disclaimer was for a purpose that the disclaimer statute (R. S. Sec. 4917, 35 U. S. C. 65) was never designed to permit (Authorities, Defts.' Main Brief, pp. 42, 44). Refused

63. The disclaimer is without statutory basis (Authorities, Defts.' Main Brief, pp. 44-45). Refused

64. The disclaimer and the claims in suit are invalid (Authorities, Defts.' Main Brief, pp. 46-52). Refused

65. The disclaimer deprives the patent in suit of any presumption of validity (Authorities, Defts.' Main Brief, pp. 46, 47). Refused

IX. The Claims Are Unenforceable.

Findings of Fact:

66. None of the claims in suit is an original claim (Defts.' Main Brief, p. 39). They were inserted in the application by amendment on the following dates: claim 5 on March 25, 1925, claim 7 on March 25, 1925, claim 9 on May 3, 1928, claim 13 on December 6, 1928, claim 17 on March 6, 1929, claim 18 on March 6, 1929, and claim 19 on April 10, 1929 (Defts.' Main Brief, p. 39). All the claims in suit were amended and expanded by the disclaimer to cover defendants' machines Refused

which had already gone into public use (Defts.' Main Brief, pp. 39-46, 120).

Refused as put

67. It was not until May 2, 1928 (P. Ex. 1, p. 73) after flexing or arcuate bending of the film, and passing the film over a substantial portion of the periphery of a cylinder or sprocket, had been used commercially (Tr. 484, 5) that the patentees first introduced it in the application as a feature of their alleged invention. At that time they inserted claim 9 and stated (P. Ex. 1, p. 74): "A new method claim is added herewith broadly covering one phase of applicant's invention which is not suggested in any way by the prior art. It will be appreciated that the mere flexing of the film into an arcuate shape and advancing the same circumferentially, may contribute greatly to the elimination of extraneous vibrations regardless of the form of mechanism used for supporting and advancing the film." (Defts.' Main Brief, p. 116).

Refused as put

68. It was not until December 6, 1928, after the optical slit had been used commercially and after R. C. A. Photophone, Inc., and others had placed on the market machines employing the optical slit, that the patentees introduced claim 13 in suit, in which the attempt was made for the first time to claim an optical slit as distinguished from a physical slit (P. Ex. 1, pp. 78, 81). The patentee then pointed out for the first time that they were claiming "means for collecting and projecting through an object glass a converged narrow line of light, which impinges *directly* upon the film *without the necessity of using any intervening slit to produce such narrow line.*" (P. Ex. 1, p. 81).

Refused as put

69. It was not until December 6, 1928, after the photoelectric cell had been used commercially and after R. C. A. Photophone, Inc., and others had placed on

the market machines employing photoelectric cells, that the patentees introduced claim 13 in suit, in which a photoelectric cell, as distinguished from a selenium cell, was claimed by the patentees for the first time (P. Ex. 1, pp. 78, 81). The patentees then pointed out for the first time that they were claiming the photoelectric cell as distinguished from other light sensitive devices (P. Ex. 1, p. 82). That no such distinction was made by the patentees when they filed their application is conclusively shown by the fact that they referred to the light sensitive element in that application as "part *z*" (later changed by amendment to light sensitive cell), as "photocell *z*" (*not* photoelectric cell); as "the light-sensitive element"; and as "light-electric element" (P. Ex. 1, pp. 4, 5, 7, 9). Furthermore, in their statement accompanying the amendment of March 25, 1925 (P. Ex. 1, p. 49), the patentees referred to the light sensitive element as a "light sensitive cell", showing conclusively that the patentees made no distinction between one or another device as long as they were sensitive to light. (Defts.' Main Brief, pp. 67, 68).

Instead of attempting to make any distinction between the photoelectric cell and the selenium cell, the patentees repeatedly referred to these devices as equivalents, as also appears from their own patents, Nos. 350,706 (D. Ex. 135, Item 5) and 1,555,281 (D. Ex. 135, Item 18). In the latter patent, for example, the patentees said (p. 2, ll. 45-46): "The light which has passed through the film calls upon a *light-sensitive member z, say a selenium cell, or a photoelectric cell with alkali metal cathode*". This patent was not applied for by the patentees until 1924. (Defts.' Reply Brief, p. 11.)

Conclusions of Law:

70. The claims in suit are unenforceable because improperly amended and expanded by the disclaimer to Refused

cover defendants' machines, which had already gone into public use (Authorities, Defts.' Main Brief, pp. 40-42, 46-52).

Refused 71. Claims 9, 17, 18 and 19 of the patent in suit, in which flexing or arcuate bending of the film, or passing the film over a substantial portion of the periphery of a cylinder or sprocket, was not claimed until after the same had gone into public use, are unlawful expansions of the application as originally filed and these claims are, therefore, both invalid and unenforceable. (Authorities, Defts.' Main Brief, p. 40.)

Refused 72. Claim 13 of the patent in suit, in which the attempt was made to claim an optical slit as distinguished from a physical slit after the optical slit had gone into public use, is an unlawful expansion of the application as originally filed, and is, therefore, both invalid and unenforceable. (Authorities, Defts.' Main Brief, p. 40).

Refused 73. Claim 13 of the patent in suit, in which the photoelectric cell as distinguished from other light sensitive devices was not claimed until after the photoelectric cell had gone into public use, is an unlawful expansion of the application as originally filed and is, therefore, both invalid and unenforceable. (Defts.' Main Brief, p. 68; Authorities, Defts.' Main Brief, p. 40.)

X. Defense That Claims 9, 13, 17, 18 and 19 Are for an Alleged Invention Which Is Different From the Alleged Invention of the Original Application.

Finding of Fact:

Refused 74. Claims 9, 13, 17, 18 and 19 are each for an alleged invention which is different from the alleged

invention of the original application (Defts.' Main Brief, pp. 114-118).

Conclusion of Law:

75. Being for an alleged invention which is different from the alleged invention of the original application, claims 9, 13, 17, 18 and 19 are invalid (Authorities, Defts.' Main Brief, pp. 114, 116-118). Refused

XI. Defense That Claims 9, 18 and 19 Merely Describe the Function of a Machine and Not a Patentable Process.

Finding of Fact:

76. Claims 9, 18 and 19, which are in the form of method or process claims, described merely the function of a machine and not a patentable process (Defts.' Main Brief, pp. 118-120). Refused

Conclusion of Law:

77. Claims 9, 18 and 19 are invalid because they describe merely the function of a machine and not a patentable process (Authorities, Defts.' Main Brief, pp. 119-120). Refused

XII. Defense That Claim 7 Is Inoperative.

Finding of Fact:

78. Figs. 5 and 6 of the patent in suit and claim 7 which is based thereon are inoperative because an undamped spring drive is inoperative, and damping is not disclosed in the patent in suit (Defts.' Main Brief, pp. 33-34, 94-96). This fact was conclusively demonstrated by the defendants at the trial (Defts.' Main Brief, pp. 33, 94). Refused

Conclusion of Law:

Refused 79. Claim 7 is invalid because inoperative.

XIII. Defense of Non-Infringement.

Findings of Fact:

Refused 80. Defendants' machines differ greatly in construction and arrangement from the machines disclosed in the patent in suit (Defts.' Main Brief, pp. 120-125; Abstract of Argument for Defts., pp. 9, 10).

Refused 81. Defendants' machine type PS-1 was placed on the market as early as October 28, 1928, before the patent in suit issued, and defendants' machine type PS-16 was placed on the market in 1929. Neither the construction nor arrangement of either of defendants' machines was copied from the patent in suit or from the patentees' machines (Defts.' Main Brief, p. 120).

Refused 82. In spirit the defendants' machines are not similar to the machines shown in the patent in suit but are like the prior art (Defts.' Main Brief, pp. 124, 125).

Refused 83. The claims in suit cannot be read on defendants' machines without also reading on the prior art (Defts.' Main Brief, p. 125).

Conclusion of Law:

Refused 84. If the claims in suit are construed so as to be infringed by defendants' machines, they are invalid over the prior art (Authorities, Defts.' Main Brief, p. 125).

XIV. The Commercialization of Talking Motion Pictures.

Findings of Fact:

Refused 85. Plaintiffs are merely patent holding and exploiting companies (Defts.' Main Brief, p. 2).

86. No commercial success is shown by the plaintiffs and the patentees made no real contribution to the art (Defts.' Main Brief, pp. 142-144; Defts.' Reply Brief, pp. 3, 4). Refused

87. The patentees' attempt to exploit their machines in Germany prior to 1926 was unsuccessful (Defts.' Main Brief, p. 143; Defts.' Reply Brief, pp. 6-9). Refused

88. The modern talking picture first succeeded commercially in the United States in August, 1926 and this success revolutionized the motion picture industry throughout the world (Defts.' Main Brief, p. 143). Refused

89. The success of the modern talking picture was not due to the solution of any mechanical problem such as providing uniform motion, but to the many electrical devices, including high quality, distortionless vacuum tube amplifiers, loud speakers and microphones, which had first to be developed and which were developed by the electrical companies in the United States (Defts.' Main Brief, pp. 143-146; Defts.' Reply Brief, p. 3; For the prior decisions which so hold see Defts.' Main Brief, pp. 144-146). Refused

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ORDER.

The above answers are made and the requests with answers are ordered filed this twenty-fourth day of November, 1933.

ALBERT W. JOHNSON,
U. S. District Judge.

INTERLOCUTORY DECREE.

In Equity No. 971.

(Filed December 16, 1933.)

This cause having come on to be heard at final hearing upon the pleadings and proofs filed herein on behalf of plaintiffs and defendant, and having been argued by counsel.

Now, therefore, upon consideration thereof, it is ORDERED, ADJUDGED and DECREED as follows:

1. That plaintiff, American Tri-Ergon Corporation, is a corporation organized and existing under the laws of the State of New York, with its principal place of business in the Borough of Manhattan, County and State of New York, and is the lawful owner of the patent in suit, United States Letters Patent No. 1,713,726, granted May 21, 1929, and of the entire right, title and interest in, to and under said letters patent, save for exclusive license rights thereunder for certain purposes only, owned by plaintiff, Tri-Ergon Holding A. G., a corporation organized and existing under the laws of Switzerland.

2. That said letters patent are good and valid in law as to claims 9, 13, 17, 18 and 19 thereof; and that Hans Vogt, Joseph Massolle and Josef Engl, the applicants for said patent, were the first, true, original and joint inventors of the invention and improvements shown and described in said letters patent and claimed in said claims thereof.

3. That the defendant, Altoona Publix Theatres, Inc., is a corporation of the State of Delaware, and has a place of business at Huntingdon, Huntingdon County, Pennsylvania, and has infringed upon the

aforesaid claims of said letters patent, by using in the Grand Theatre at Huntingdon, Pa., which theatre is operated by said defendant, machines for reproducing sound on film talking motion pictures, of a type known as "PS-16" machines, which were leased to said defendant by R. C. A. Photophone, Inc., a corporation of Delaware. The said machines are diagrammatically illustrated in plaintiffs' exhibits in evidence herein, Nos. 15D, 15E and 15F.

4. That a perpetual injunction issue out of and under the seal of this Court enjoining and restraining the said defendant, its officers, directors, servants, agents, employees, and all others acting for or on behalf of it, and each of them, from directly or indirectly making or causing to be made, using or causing to be used, vending or offering to make or vend, any machine or method embodying or employing the invention of said claims 9, 13, 17, 18 and 19 of said Letters Patent No. 1,713,726, and particularly from making, using, selling or causing to be made, used or sold, the said type "PS-16" machine, or from directly or contributorily infringing upon or violating in any manner whatsoever, the said claims of said letters patent.

5. That the defendant account for and pay over to the plaintiffs all of the profits, gains and advantages which have accrued to or been earned or received by said defendant from its infringement of the said claims of said letters patent, and all gains and profits as would have accrued to or been earned by plaintiffs but for said infringement, and also all damages which plaintiffs have sustained by reason of said infringement.

6. That unless an appeal be duly taken herefrom, a Master shall be appointed by this Court upon the expiration of the appeal period, to ascertain, state and report an accounting of the profits, gains and advantages which have accrued to the defendant by reason

of its infringement of the said claims of said letters patent, and the damages sustained by the plaintiffs by reason of such infringement, and to report thereon with all convenient speed; and that on such accounting plaintiffs shall have the right to cause an examination to be made of the said defendant or of its officers, agents, attorneys, clerks, servants, employees, workmen, *ore tenus* or otherwise, and also to cause the production of the books, papers, vouchers, statements, accounts, documents, and correspondence of said defendant within this district or elsewhere, as the said Master shall direct, or to examine such other witnesses as the said Master shall determine within this district or elsewhere, and that the said defendant, its officers, agents, attorneys, clerks, servants, employees, workmen, hereby are directed and required to attend before the Master upon the accounting from time to time within this district or elsewhere as the Master shall direct, and to produce before him such books, papers, vouchers, statements, accounts, documents, and correspondence, and to submit to such oral examination as the Master may require; and that all testimony and exhibits offered and used in this cause on behalf of either party may be referred to and used in such accounting.

7. That the plaintiffs recover of the defendant their costs and disbursements of this suit to be taxed.

8. That this suit has been defended by said R. C. A. Photophone, Inc., which is a wholly-owned subsidiary of Radio Corporation of America.

December 16, 1933.

(Sgd.) ALBERT W. JOHNSON,
United States District Judge.

Dated: December 14, 1933.

Approved as to form:

O'MALLEY, HILL, HARRIS & HARRIS,
Counsel for Defendant.

PETITION FOR APPEAL.

In Equity No. 971.

(Filed December 16, 1933.)

The above-named defendant, Altoona Publix Theatres, Inc., considering itself aggrieved by the decree entered herein on the sixteenth day of December, 1933, does hereby appeal from the said decree to the United States Circuit Court of Appeals for the Third Circuit, for the reasons specified in the assignment of errors filed herewith, and it prays that this appeal may be allowed and that a transcript of record, proceedings and exhibits upon which the said decree was made, duly authenticated, together with such original matters as cannot be reproduced, may be sent to the United States Circuit Court of Appeals for the Third Circuit; and defendant further prays that all further proceedings herein be stayed during the pendency of this appeal.

ALTOONA PUBLIX THEATRES, INC.

By (Sgd.) HENRY R. ASHTON,
Counsel.

December 16, 1933.

ORDER ALLOWING APPEAL AND SUPERSEDEAS ORDER.

In Equity No. 971.

(Filed December 16, 1933.)

The defendant having presented its petition for an appeal, it is ORDERED:

1. That the defendant's appeal is allowed as prayed for and the clerk of this court is directed to issue a citation to the plaintiffs and to certify the record to be transmitted to the Circuit Court of Appeals.

2. That the operation of the decree of this court, entered simultaneously herewith, granting an injunction and an accounting, and all proceedings thereunder be and the same are hereby stayed and suspended during the pendency of the said appeal.

3. That this order is made on the condition that the defendant file a bond in the amount of two thousand dollars ($2000) conditioned to reimburse the plaintiffs for their costs on the appeal and for all profits and damages which may eventually be adjudged to be due to the plaintiffs from the defendant by reason of defendant's infringement during the pendency of the said appeal of claims 9, 13, 17, 18 and 19 of United States Letters Patent No. 1,713,726; the amount of said bond being an arbitrary one agreed upon by the parties to expedite the appeal, without any reference to the actual amount of profits or damages to which the plaintiffs may ultimately be adjudged to be entitled to in any accounting proceeding herein.

ALBERT W. JOHNSON,
United States District Judge.

Dated: December 16, 1933.

Consented to by both parties:

S. MORTIMER WARD, JR.,
Counsel for Plaintiffs.

HENRY R. ASHTON,
Counsel for Defendant.

ASSIGNMENT OF ERRORS.

In Equity No. 971.

(Filed December 16, 1933.)

The defendant, in support of its appeal, asserts that this Court erred in the following respects:

1. In holding claims 9, 13, 17, 18 and 19 of said Letters Patent No. 1,713,726 good and valid in law and in failing to hold the said claims invalid and void.

2. In holding that the defendant infringed the said claims of said Letters Patent No. 1,713,726 and in failing to hold the said claims not infringed by the defendant.

3. In ordering an injunction and accounting and assessing the costs against the defendant and in failing to dismiss the bill of complaint and assessing the costs against the plaintiffs.

4. In finding as facts the matters stated in plaintiff's proposed findings of fact Nos. 1 to 74, inclusive, and in entering as conclusions of law the matters stated in plaintiffs' proposed conclusions of law Nos. 1 to 33, inclusive, and 35 to 38, inclusive.

5. In failing to find as facts the facts as stated in defendants' proposed findings Nos. 6, 17 to 28, inclusive, 31 to 33, inclusive, 47 to 50, inclusive, 57, 58, 60, 61, 66 to 69, inclusive, 74, 76, 78, 80 to 83, inclusive, and 85 to 89, inclusive; and in failing to enter as conclusions of law the conclusions of law stated in defendants' proposed conclusions Nos. 34 to 46, inclusive, 51, 55, 56, 59, 62 to 65, inclusive, 70 to 73, inclusive, 75, 77, 79 and 84.

ALTOONA PUBLIX THEATRES, INC.

By (Sgd.) HENRY R. ASHTON,
Counsel for Defendant.

BOND FOR COSTS ON APPEAL AND SUPERSEDEAS.

In Equity No. 971.

(Filed December 16, 1933.)

KNOW ALL MEN BY THESE PRESENTS, that Radio Corporation of America, a corporation organized and existing under the laws of the State of Delaware, as principal, and National Surety Corporation, a corporation organized and existing under the laws of the State of New York, as surety, are held and firmly bound unto American Tri-Ergon Corporation and Tri-Ergon Holding, A. G., in the full and just sum of two thousand dollars ($2000), to be paid to the said American Tri-Ergon Corporation and Tri-Ergon Holding, A. G., their successors or assigns, for the payment of which well and truly to be made, we bind ourselves, our successors and assigns, jointly and/or severally, by these presents.

Sealed with our seals, and dated the twelfth day of December, 1933.

WHEREAS, lately at the District Court of the United States for the Middle District of Pennsylvania in a suit pending in said court between American Tri-Ergon Corporation and Tri-Ergon Holding, A. G., plaintiffs, and Altoona Publix Theatres, Inc., defendant, a decree was entered against the said defendant and it having taken an appeal to the United States Circuit Court of Appeals for the Third Circuit, to reverse the said decree; and

WHEREAS, an order was entered on the day of December, 1933, allowing the said appeal and staying the injunction, accounting and all proceedings thereunder, during the pendency of the said appeal, provided this bond be given:

Now, Therefore, the condition of this obligation is such that if the principal shall reimburse the plaintiffs for plaintiffs' costs of the said appeal and for all profits and damages which may eventually be adjudged to be due to the plaintiffs from the defendant by reason of defendant's infringement during the pendency of the said appeal of claims 9, 13, 17, 18 and 19 of United States Letters Patent No. 1,713,726, then this obligation to be void; otherwise to remain in full force and effect.

RADIO CORPORATION OF AMERICA,

By Otto S. Schairer,
Vice-President.

Attest:

H. S. Grover.

NATIONAL SURETY CORPORATION,

By J. A. Little,
Attorney-in-Fact.
(Seal of National)
(Surety Corporation)

CITATION.

In Equity No. 971.

(Filed December 18, 1933.)

UNITED STATES OF AMERICA, *ss.:*

THE PRESIDENT OF THE UNITED STATES,

To American Tri-Ergon Corporation and Tri-Ergon Holding, A. G.,

GREETING:

You are hereby cited and admonished to be and appear in the United States Circuit Court of Appeals for the Third Circuit in the City of Philadelphia, State of Pennsylvania, on the fifteenth day of January, 1934, pursuant to an appeal obtained from a decree of the District Court of the United States for the Middle District of Pennsylvania, entered therein on the sixteenth day of December, 1933, in the cause therein pending wherein you are plaintiffs-appellees, and Altoona Publix Theatres, Inc., is defendant-appellant, and show cause, if any there be, why the decree against the defendant-appellant should not be corrected and why speedy justice should not be done to the parties in that behalf.

Given under my hand this sixteenth day of December, 1933.

(Sgd.) ALBERT W. JOHNSON,
United States District Judge.

Service of this citation, with copy, acknowledged this eighteenth day of December, 1933.

(Sgd.) PHILIP J. MATTES,
Of Counsel for Plaintiffs-Appellees.

INTERLOCUTORY DECREE.

In Equity No. 972.

(Filed December 15, 1933.)

This cause having come on to be heard at final hearing upon the pleadings and proofs filed herein on behalf of plaintiffs and defendants, and having been argued by counsel.

Now, therefore, upon consideration thereof, it is ORDERED, ADJUDGED and DECREED as follows:

1. That plaintiff, American Tri-Ergon Corporation, is a corporation organized and existing under the laws of the State of New York, with its principal place of business in the Borough of Manhattan, County and State of New York, and is the lawful owner of the patent in suit, United States Letters Patent No. 1,713,726, granted May 21, 1929, and of the entire right, title and interest in, to and under said letters patent, save for exclusive license rights thereunder for certain purposes only, owned by plaintiff, Tri-Ergon Holding A. G., a corporation organized and existing under the laws of Switzerland.

2. That said letters patent are good and valid in law as to claims 5, 7, 9, 13, 18 and 19 thereof; and that Hans Vogt, Joseph Massolle and Josef Engl, the applicants for said patent, were the first, true, original and joint inventors of the invention and improvements shown and described in said letters patent and claimed in said claims thereof.

3. That the defendant, Wilmer & Vincent Corporation, is a corporation of the State of Delaware and has a place of business at Harrisburg, County of Dauphin, Pennsylvania; that the defendant, Locust Street Real

Estate Company, is a corporation of the State of Pennsylvania, and has a place of business at Harrisburg, County of Dauphin, Pennsylvania; that the said defendants have infringed upon the aforesaid claims of said letters patent by using in the State Theatre at Harrisburg, Pennsylvania, machines for reproducing sound on film talking motion pictures, of a type known as "PS-1" machines. The defendant, Locust Street Real Estate Company, owns said theatre and leased the said machines from R. C. A. Photophone, Inc., a corporation of Delaware, and the said theatre and machines were operated by the defendant Wilmer & Vincent Corporation. The said machines are diagrammatically illustrated in plaintiffs' exhibits in evidence herein, Nos. 15-A, 15-B and 15-C.

4. That a perpetual injunction issue out of and under the seal of this court enjoining and restraining the said defendants, their officers, directors, servants, agents, employees, and all others acting for or on behalf of them, and each of them, from directly or indirectly making or causing to be made, using or causing to be used, vending or offering to make or vend, any machine or method embodying or employing the invention of said claims 5, 7, 9, 13, 18 and 19 of said Letters Patent No. 1,713,726, and particularly from making, using, selling or causing to be made, used or sold, the said type "PS-1" machine, or from directly or contributorily infringing upon or violating in any manner whatsoever, the said claims of said letters patent.

5. That the defendants account for and pay over to the plaintiffs all of the profits, gains and advantages which have accrued to or been earned or received by said defendants and each of them from their infringement of the said claims of said letters patent, and all gains and profits as would have accrued to or been

earned by plaintiffs but for said infringement, and also all damages which plaintiffs have sustained by reason of said infringement.

6. That unless an appeal be duly taken herefrom, a Master shall be appointed by this Court upon the expiration of the appeal period, to ascertain, state and report an accounting of the profits, gains and advantages which have accrued to the defendants and each of them by reason of their infringement of the said claims of said letters patent, and the damages sustained by the plaintiffs by reason of such infringement, and to report thereon with all convenient speed, and that on such accounting plaintiffs shall have the right to cause an examination to be made of the said defendants or of their officers, agents, attorneys, clerks, servants, employees, workmen, *ore tenus* or otherwise, and also to cause the production of the books, papers, vouchers, statements, accounts, documents, and correspondence of said defendants within this district or elsewhere, as the said Master shall direct, or to examine such other witnesses as the said Master shall determine within this district or elsewhere, and that the said defendants, their officers, agents, attorneys, clerks, servants, employees, workmen, hereby are directed and required to attend before the Master upon the accounting from time to time within this district or elsewhere as the Master shall direct, and to produce before him such books, papers, vouchers, statements, accounts, documents and correspondence, and to submit to such oral examination as the Master may require; and that all testimony and exhibits offered and used in this cause on behalf of either party may be referred to and used in such accounting.

7. That the plaintiffs recover of the defendants their costs and disbursements of this suit to be taxed.

8. That this suit has been defended by said R. C. A. Photophone, Inc., which is a wholly owned subsidiary of Radio Corporation of America.

December 16, 1933.

(Sgd.) ALBERT W. JOHNSON,
United States District Judge.

Dated: December 14, 1933.
Approved as to form:

(Sgd.) O'MALLEY, HILL, HARRIS & HARRIS,
Counsel for Defendants.

PETITION FOR APPEAL.

In Equity No. 972.

(Filed December 16, 1933.)

The above-named defendants, Wilmer & Vincent Corporation and Locust Street Real Estate Company, considering themselves aggrieved by the decree entered herein on the sixteenth day of December, 1933, do hereby appeal from the said decree to the United States Circuit Court of Appeals for the Third Circuit, for the reasons specified in the assignment of errors filed herewith, and they pray that this appeal may be allowed and that a transcript of record, proceedings and exhibits upon which the said decree was made, duly authenticated, together with such original matters as cannot be reproduced, may be sent to the United States Circuit Court of Appeals for the Third Circuit; and defendants further pray that all further proceedings herein be stayed during the pendency of this appeal.

WILMER & VINCENT CORPORATION AND LOCUST STREET REAL ESTATE COMPANY.

By (Sgd.) HENRY R. ASHTON,
Counsel.

December 16, 1933.

ORDER ALLOWING APPEAL AND SUPERSEDEAS ORDER.

In Equity No. 972.

(Filed December 16, 1933.)

The defendants having presented their petition for an appeal herein, it is ORDERED:

1. That the defendants' appeal is allowed as prayed for and the clerk of this court is directed to issue a citation to the plaintiffs and to certify the record to be transmitted to the Circuit Court of Appeals.

2. That the operation of the decree of this court, entered simultaneously herewith, granting an injunction and an accounting, and all proceedings thereunder be and the same are hereby stayed and suspended during the pendency of the said appeal.

3. That this order is made on the condition that the defendants file a bond in the amount of two thousand dollars ($2000) conditioned to reimburse the plaintiffs for their costs on the appeal and for all profits and damages which may eventually be adjudged to be due to the plaintiffs from the defendants by reason of defendants' infringement during the pendency of the said appeal of claims 5, 7, 9, 13, 18 and 19 of United States Letters Patent No. 1,713,726; the amount of said bond being an arbitrary one agreed upon by the parties to expedite the appeal, without any reference to the actual amount of profits or damages to

which the plaintiffs may ultimately be adjudged to be entitled to in any accounting proceeding herein.

ALBERT W. JOHNSON,
United States District Judge.

Dated December 16, 1933.

Consented to by both parties:

S. MORTIMER WARD, JR.,
Counsel for Plaintiffs.
HENRY R. ASHTON,
Counsel for Defendants.

ASSIGNMENT OF ERRORS.

In Equity No. 972.

(Filed December 16, 1933.)

The defendants, in support of their appeal, assert that this Court erred in the following respects:

1. In holding claims 5, 7, 9, 13, 18 and 19 of said Letters Patent No. 1,713,726 good and valid in law and in failing to hold the said claims invalid and void.

2. In holding that the defendants infringed the said claims of said Letters Patent No. 1,713,726 and in failing to hold the said claims not infringed.

3. In ordering an injunction and accounting and assessing the cost against the defendants and in failing to dismiss the bill of complaint and assessing the costs against the plaintiffs.

4. In finding as facts the matters stated in plaintiffs' proposed findings of fact Nos. 1 to 74, inclusive and in entering as conclusions of law the matters stated in plaintiffs' proposed conclusions of law Nos. 1 to 33, inclusive, and 35 to 38, inclusive.

5. In failing to find as facts the facts as stated in defendants' proposed findings Nos. 6, 17 to 28, inclusive, 31 to 33, inclusive, 47 to 50, inclusive, 57, 58, 60, 61, 66 to 69, inclusive, 74, 76, 78, 80 to 83, inclusive, and 85 to 89, inclusive; and in failing to enter as conclusions of law the conclusions of law stated in defendants' proposed conclusions Nos. 34 to 46, inclusive, 51, 55, 56, 59, 62 to 65, inclusive, 70 to 73, inclusive, 75, 77, 79 and 84.

WILMER & VINCENT CORPORATION AND LOCUST STREET REAL ESTATE COMPANY.

By (Sgd.) HENRY R. ASHTON,
Counsel for Defendants.

BOND FOR COSTS ON APPEAL AND SUPERSEDEAS.

In Equity No. 972.

(Filed December 16, 1933.)

KNOW ALL MEN BY THESE PRESENTS, that Radio Corporation of America, a corporation organized and existing under the laws of the State of Delaware, as principal, and National Surety Corporation, a corporation organized and existing under the laws of the State of New York, as surety, are held and firmly bound unto American Tri-Ergon Corporation and Tri-Ergon Holding, A. G., in the full and just sum of two thousand dollars ($2000), to be paid to the said American Tri-Ergon Corporation and Tri Ergon Holding, A. G., their successors or assigns, for the payment of which well and truly to be made, we bind ourselves, our successors and assigns, jointly and/or severally, by these presents.

Sealed with our seals, and dated the twelfth day of December, 1933.

WHEREAS, lately at the District Court of the United States for the Middle District of Pennsylvania in a suit pending in said court between American Tri-Ergon Corporation and Tri-Ergon Holding, A. G., plaintiffs, and Wilmer & Vincent Corporation and Locust Street Real Estate Company, defendant, a decree was entered against the said defendant and it having taken an appeal to the United States Circuit Court of Appeals for the Third Circuit, to reverse the said decree; and

WHEREAS, an order was entered on the sixteenth day of December, 1933, allowing the said appeal and

staying the injunction, accounting and all proceedings thereunder, during the pendency of the said appeal, provided this bond be given:

Now, Therefore, the condition of this obligation is such that if the principal shall reimburse the plaintiffs for plaintiffs' costs of the said appeal and for all profits and damages which may eventually be adjudged to be due to the plaintiffs from the defendants by reason of defendants' infringement during the pendency of the said appeal of claims 5, 7, 9, 13, 18 and 19 of United States Letters Patent No. 1,713,726, then this obligation to be void; otherwise to remain in full force and effect.

RADIO CORPORATION OF AMERICA,

By Otto S. Schairer,
Vice-President.

Attest:

H. S. Grover.

NATIONAL SURETY CORPORATION,

By J. A. Little,
Attorney-in-Fact.

(Seal of National)
(Surety Corporation)

CITATION.

In Equity No. 972.

(Filed December 18, 1933.)

UNITED STATES OF AMERICA, *ss.:*

THE PRESIDENT OF THE UNITED STATES,

To American Tri-Ergon Corporation and Tri-Ergon Holding, A. G.,

GREETING:

You are hereby cited and admonished to be and appear in the United States Circuit Court of Appeals for the Third Circuit in the City of Philadelphia, State of Pennsylvania, on the fifteenth day of January, 1934, pursuant to an appeal obtained from a decree of the District Court of the United States for the Middle District of Pennsylvania, entered therein on the sixteenth day of December, 1933, in the cause therein pending wherein you are plaintiffs-appellees, and Wilmer & Vincent Corporation and Locust Street Real Estate Company are defendants-appellants, and show cause, if any there be, why the decree against the defendants-appellants should not be corrected and why speedy justice should not be done to the parties in that behalf.

Given under my hand this sixteenth day of December, 1933.

(Sgd.) ALBERT W. JOHNSON,
United States District Judge.

Service of this citation, with copy, acknowledged this seventeenth day of December, 1933.

(Sgd.) PHILIP J. MATTES,
Of Counsel for Plaintiffs-Appellees.

ORDER APPROVING RECORD.

The statement of evidence as contained in the record on appeal herein is hereby approved as true, complete and properly prepared.

.....
United States District Judge.

Consented to:

.....
Counsel for Plaintiffs.

.....
Counsel for Defendants.

STIPULATED PRÆCIPE FOR RECORD ON APPEAL.

In Equity Nos. 971 and 972.

It is stipulated and agreed by and between the parties hereto that the record on appeal herein shall include the following:

1. Docket entries in both suits.

1a. Statement that original bill of complaint in suit No. 971 (giving parties) was filed on October 10, 1932.

2. Amended bill of complaint in suit No. 971.

3. Statement that original answer in suit No. 971 was filed on February 28, 1933.

4. Amended answer in suit No. 971.

5. Bill of complaint in suit No. 972.

6. Amendment to bill of complaint in suit No. 972.

7. Statement that original answer in suit No. 972 was filed on February 28, 1933.

8. Amended answer in suit No. 972.

9. Order dated June 22, 1933 amending amended answers in both suits.

10. Condensed statement of the evidence, including the testimony and exhibits, the exhibits to be dealt with as stated below:

(a) Exhibits to be reproduced or duplicated:

Plaintiffs' Exhibits—1 to 7, inclusive, 10, 13, 15, 15-A to 15-F, inclusive, 17 to 19-A, inclusive, 22 to 24, inclusive, 26 to 32, inclusive, 35, 38, 40 to 53, inclusive, 55, 57, 59, 60, 70, 71, 84 to 86, inclusive, 90-A, 90-B, 94.

Defendants' Exhibits—2, 4, 6, 9-A to 10, inclusive, 13-A to 16, inclusive, 20 to 24, inclusive, 29, 30, 35-A, 35-B, 40 to 42, inclusive, 48 to 50, inclusive, 52 to 71, inclusive, 74, 75, 76-A, 77-A, 78-A to 78-C, inclusive, 79-A to 79-C, inclusive, 80-A, 81-A, 82-A, 83-A to 83-C, inclusive, 84-A, 85-A, 85-B, 86-A, 87-A, 88-A, 89-R to 89-X, inclusive, 94, 95, 106 to 110, inclusive, 112, 114 to 120-B, inclusive, 127 to 134, inclusive, 137, 139, 140, 142, 146-A (translation of excerpt), 146-B (translation of excerpt), 148 to 153, inclusive, 159-A to 159-G, inclusive.

(b) Exhibits to be identified in the printed record but transmitted to the Court of Appeals as physical exhibits.

Plaintiffs' Exhibits—8, 9, 11, 12, 12-A, 14-A to 14-G, inclusive, 16-A to 16-F, inclusive, 20, 21, 25, 33 to 34-D, inclusive, 36, 39, 54, 56, 58, 61 to 69, inclusive, 72 to 83, inclusive, 87 to 89, inclusive, 91 to 93, inclusive.

Defendants' Exhibits—1, 3, 5, 7, 8, 11, 12, 17 to 19-LLL, inclusive, 25 to 28, inclusive, 31 to 34, inclusive, 36 to 39, inclusive, 43 to 47, inclusive, 51, 72, 73, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89-A to 89-K, inclusive, 90-A to 93, inclusive, 96 to 105, inclusive, 111, 113-A, 113-B, 121 to 126, inclusive, 135, 136, 138, 141-A 141-B, 143-A to 145, inclusive, 146-A, German of complete decision, 146-B, German of complete decision, 147, 154-A to 158, inclusive.

11. Opinion.

12. Memorandum of corrections of opinion.

13. Plaintiffs' proposed findings of fact and conclusions of law with Court's endorsements thereon and order ordering same to be filed.

14. Defendants' proposed findings of fact and conclusions of law with Court's endorsements thereon and order ordering same to be filed.

15. Decree in suit No. 971.

16. Petition for an appeal in suit No. 971.

17. Order allowing appeal and supersedeas order in suit No. 971.

18. Assignment of errors in suit No. 971.

19. Bond for costs and supersedeas in suit No. 971.

20. Citation in suit No. 971.

21. Decree in suit No. 972.

22. Petition for an appeal in suit No. 972.

23. Order allowing appeal and supersedeas order in suit No. 972.

24. Assignment of errors in suit No. 972.

25. Bond for costs and supersedeas in suit No. 972.

26. Citation in suit No. 972.

27. Order approving the statement of evidence as true, complete and properly prepared.

28. This stipulated præcipe.

29. Stipulation as to correctness of record.

30. Clerk's certificate.

PAGE S. HASELTON,
Counsel for Plaintiffs.
HENRY R. ASHTON,
Counsel for Defendants.

STIPULATION AS TO CORRECTNESS OF RECORD.

It is stipulated by and between the parties hereto that the record on appeal herein is true, complete and properly prepared.

.....
Counsel for Plaintiffs.

.....
Counsel for Defendants.

CLERK'S CERTIFICATE.

UNITED STATES OF AMERICA,
EASTERN DISTRICT OF PENNSYLVANIA, } *ss.:*

I, S. W. HOFFORD, clerk of the United States District Court in and for the Middle District of Pennsylvania, do hereby certify that the annexed and foregoing is a true and full copy of so much of the pleas and proceedings; in the cases American Tri-Ergon Corporation and Tri-Ergon Holding, A. G., Plaintiffs v. Altoona Publix Theatres, Inc., Defendant, No. 971, June Term, 1932; and American Tri-Ergon Corporation and Tri-Ergon Holding, A. G., Plaintiffs v. Wilmer & Vincent Corporation and Locust Street Real Estate Company, Defendants, No. 972, June Term, 1932; as per stipulation filed, a copy of which is hereto annexed, the transcript of record in the above-entitled cause is to include, and now remaining among the records of the said Court in my office.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the seal of
(Seal) the aforesaid Court at Scranton this
day of .

S. W. HOFFORD,
Clerk.

[fol. 1] IN THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT, MARCH TERM, 1934

No. 5392

ALTOONA PUBLIX THEATRES, INC., Appellant,

vs.

AMERICAN TRI-ERGON CORP. and TRI-ERGON HOLDING, A. G., Appellees

No. 5393

WILMER & VINCENT CORP. and LOCUST STREET REAL ESTATE CO., Appellants,

vs.

AMERICAN TRI-ERGON CORP. and TRI-ERGON HOLDING, A. G., Appellees

And afterwards, to wit, the 11th day of April, 1934 come the parties aforesaid by their counsel aforesaid, and this case being called for argument sur pleadings and briefs, before the Honorable Joseph Buffington, Honorable J. Warren Davis and Honorable J. Whitaker Thompson, Circuit Judges, and the Court not being fully advised in the premises, takes further time for the consideration thereof,

And afterwards, to wit, on the 13th day of June, 1934 come the parties aforesaid by their counsel aforesaid, and the Court, now being fully advised in the premises, renders the following decision:

IN THE
UNITED STATES CIRCUIT COURT OF APPEALS,
FOR THE THIRD CIRCUIT.

No. 5392. March Term, 1934.

ALTOONA PUBLIX THEATRES, INC.,
Defendant-Appellant,

v.

AMERICAN TRI-ERGON CORPORATION AND TRI-ERGON HOLDING, A. G.,
Plaintiffs-Appellees.

No. 5393. March Term, 1934.

WILMER & VINCENT CORPORATION AND LOCUST STREET REAL ESTATE COMPANY,
Defendants-Appellants,

v.

AMERICAN TRI-ERGON CORPORATION AND TRI-ERGON HOLDING, A. G.,
Plaintiffs-Appellees.

APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES, FOR THE MIDDLE DISTRICT OF PENNSYLVANIA.

OPINION.

(Filed June 13, 1934.)

Before BUFFINGTON, DAVIS and THOMPSON, *Circuit Judges.*

BUFFINGTON, *Circuit Judge.*

This is an appeal from a decree of the district court holding claims 5, 7, 9, 13, 17, 18 and 19 of United States Patent No. 1,713,726, valid and infringed.

The main contest below and here is on the validity of the claims in suit. If they are valid, infringement, while not admitted, is rather feebly pressed. The patent, including the claims in issue, is presumptively valid, both as to novelty and utility. Lehnbeuter v. Holthaus, 105 U. S. 94; Johnson Automobile Lock Co. v. Noser Instant Auto Lock Co., 9 Fed. (2d) 265, 267; Galvin Electric Mfg. Co. v. Emerson Electric Mfg. Co., 19 Fed. (2d) 885. This follows from the grant of the patent by the Commissioner of Patents and the finding of the district judge. Apparently extrinsic evidence was necessary to explain the terms and state of the art and after hearing in open court that evidence, much of which was conflicting and directly contradictory, the trial judge, upon extensive findings of fact and conclusions of law, held the claims in issue to be valid and infringed. We could affirm the decree upon his able and comprehensive opinion. Where facts have been found by a proper party or tribunal, a decree based thereon will not be reversed by an appellate court unless it is obvious that a plain mistake has been made. Tilghman v. Proctor, 125 U. S. 136, 149; Crawford v. Neal, 144 U. S. 585; Furrer v. Ferris, 145 U. S. 132; Davis v. Schwartz, 155 U. S. 631, 636; Hutchins v. Munn, 209 U. S. 246, 250. No such mistake appears here. However, we have decided to state our own conclusions upon the facts and the law.

The patent deals with recording photographic sound on film and the reproduction therefrom for use in talking moving pictures as distinguished from recording and reproducing sound on disk which had long been used on phonographs. The patent contains

both apparatus and method claims. Of the claims in issue, claims 5, 7, 13 and 17 are for an apparatus and claims 9, 18 and 19 are for a method.

The art of photographic sound recording involves the translation of light upon a photographic film. Reproduction therefrom involves translation of the sound record on such a film into acoustically modulated electric currents through the medium of light. The patentees claim to be the first to have conceived this idea. However that may be, the practical problem was how to utilize it in overcoming distortion in reproducing sound in talking moving pictures.

Ruhmer, the German scientist, had the idea and tried to solve the problem of using it in the production of talking moving pictures, but without success, and his abandoned experiments are recognized as only a crude beginning of what the patentees after years of patient research accomplished. Edison also had the idea but his efforts, culminating in the use of a cylinder phonogram, synchronized with a picture machine, failed to produce any results that had any effect upon the art. Others tried and failed. The patentees working together for years on this problem finally solved it and gave to the world a machine and method which revolutionized the moving picture art and drove "sound on disk sound pictures from the market".

The inventors had to overcome many difficulties before they successfully produced and translated sound on film sound pictures. One of the difficulties was to overcome what is called "distortion" of sound. Records on picture film contain many hundreds per inch of precisely placed photographic fine lines varying in frequency and transparency according to complex sound vibrations. In order to record sound without distortion, the spacing and transparency of these lines must vary precisely in accordance with the acoustically modulated light which is being photo-

graphed. In the reproducing machine, these fine photographic lines must be rapidly moved without disturbance of their frequency relationship through a focused beam of light at the point of sound translation, the light being varied according to the sound record. This acoustically modulated light shines on what is known as the photo-electric cell which converts the light variations into modulated electric currents which vary in proportion to the light variations. These light variations in turn vary according to the spacing and degree of the transparency of the photographed lines.

Light acts without inertia or friction and so does not distort the most complex and rapid sound vibrations. Attempts to use a beam of light for sound reproductions were futile before this invention, because of the presence of many disturbing factors such as irregular, intermittent and vibratory movement of the film at the translation point caused mainly by take-up reels, driving gear, imperfect meshing of the sprocket with the perforations in the film and the varying friction and irregular deflections of the film in the "straight light gate". These had never been segregated and diagnosed and then collectively remedied, until the patentees did it.

They discovered that this photo-electric cell acts without inertia in cooperation with the light beam, and that the rapidly moving, flimsy, curling film must be uniform in its movements and so controlled that the position and motion of each fine line at the beam of light must be accurate within the thousandth of an inch per small fraction of a second. Unless this is so, the synchronism between the sound and movements, in talking moving pictures, is destroyed and the reproduction a failure.

In the place of the "straight light gate", they eliminated the troublesome transverse curling and irregular buckling of the film at the sprocket perfora-

tions by arcuately bending the film longitudinally. This gave firmness to the film at the focal point of the optical system, permitted it to be free from physical supports which accumulated dust and scratched and displaced the film. They thus prevented vibrations.

The well known function of a flywheel is to give uniformity of motion by absorbing energy when speed is increased and by releasing it when speed is decreased, but this knowledge was not enough to solve the problem of preventing sound distortion in recording sound on film and in reproducing the same for which uniformity of motion is absolutely necessary. The patentees utilized this knowledge of the function of a flywheel which they made an element of their new combination in order to secure the necessary uniform motion of the flimsy film as it passed over the sound head. This small piece of trembling flimsy film, without appreciable weight, charged with the vibrations as it comes from the adjacent, intermittent movements of the picture machine, traveling over the sound head at the speed of ninety feet per second, required a uniformity measured in thousandths of an inch per small fraction of a second in order to accomplish successfully photographic sound in film reproduction by the use of extremely fine transverse lines of light. The flywheel, as used in this combination, does not attempt to regulate the irregularities of the motor and other rotating parts of the picture machine. It regulates only the small length of the film which is passing over the roller at the translation point and gives it the steadiness and uniformity of the speed which it itself possesses.

The effectiveness of the flywheel in producing uniformity of speed and in preventing irregularities and consequent distortion of sound was increased by the use of a flexible spring connection between the driving means and the flywheel shaft. While springs and elastic couplings were old, yet in this new combination

it was an element which was instrumental in producing the uniformity of rotation which was never secured in the prior art.

Again they used a focused fine line of light, called an "optical slit" through which light penetrated to record and reproduce sound. This takes the place of the old mechanical slit located directly against the film in which dust and dirt collected, obstructing light and scratching the sound record.

The prior art does not disclose this combination nor the result which it produced. The evidence shows that the moving, talking picture art was looking for something like this. The defendants point to some seventy patents, some having one element of the patent in issue, and some another, but none have this combination and none produce the result of this combination. The patentees were the first to accomplish successfully and commercially photographic sound on film reproduction. The suggestions and prophecies found in paper patents were confusing and not helpful.

This new combination of the patent was not obvious to one skilled in the art for no one else had discovered it, although many were working on it and it required years of patient study and research before the patentees were able to work out this combination and method, although some of the individual elements were old, one being found here and another there in inoperative paper patents. The defendants were unable to produce a single anticipation among the seventy or more paper patents upon which they relied.

The trial judge said that the combination and methods of the claims of the patent in issue are not found in any prior art citations and are new and useful. A close study of the citations confirms this finding. No one before the patentees was able to bring together all the elements of the patent into a successfully operative combination. Each of these elements coact di-

rectly with the others to produce a new and useful result, the prevention of sound distortion. It is well settled that a new combination, every element of which is old, is patentable if it produces a new and useful result, or an old result in a "new and materially better way", or an "old result in a more advantageous way". Proudfit Loose Leaf Co. v. Kalamazoo Leaf Binder Co., 230 Fed. 120, 127; Galvin Electric Mfg. Co. v. Emerson Electric Mfg. Co., 19 Fed. (2d) 885, 890; Hailes v. Van Wormer, 87 U. S. 353; Palmer v. Corning, 156 U. S. 342, 345; Grinnell Washing Machine Co. v. Johnson Co., 247 U. S. 426, 432. The patent in issue unquestionably comes within the law as thus declared.

The old cylinder or disk gramophones had flywheels or speed regulators as the patent states, but the problem there was very different from the problem here, where uniformity of speed is so absolutely necessary to reproduce photographic sound on film which is so highly sensitive to the many sources of irregularity of speed. To give uniform speed to each short piece of film, so light and flimsy that it is practically weightless, as it passes over the sound head, was the problem which the patentees alone successfully solved.

All that need to be done in order to show that the patent in suit is an entirely new combination and accomplished a new and useful result is to read and study the patent itself and then read and study any or all of the prior art patents relied on by appellants.

Defendants allege that the findings of fact made by the court are inconsistent, that those made in their favor are inconsistent with those made in favor of the plaintiffs.

These findings were presented to the court and requested by the parties respectively. Those specially referred to by defendants relate to the well known

function of flywheels generally and are not inconsistent with the findings in favor of plaintiffs when considered in connection with the combination of the patent.

One of the defenses raised by the appellants is that the invention is not a joint invention of the three patentees.

The first question arises as to what constitutes joint invention of two or more persons. The authorities are unanimous in holding that joint inventions are made when two or more persons jointly work or collaborate in devising and putting into practical form the subject matter of the patent in question. Robinson on Patents, Vol. 1, page 567, says:

> "It is not necessary that the same idea should occur simultaneously to each. On the contrary, it is immaterial who first conceives any particular theory or plan of the invention or in what order the development of its subordinate ideas proceeds. Where two or more inventors have agreed that a result, if it could be achieved, would be desirable, neither as yet having attempted to provide a means, and from this point go forward by mutual consultations and suggestions to devise one, the means devised becomes a joint invention. . . . In short, wherever, before the entire conception of the invention by one inventor, another meets him and by his consent unites with him in exercising inventive skill upon the development and perfecting of the conception, the product of their joint endeavor is a joint invention. . . .
>
> "The same variety is possible in the exterior relations of the joint inventors, where the inventive act consists in the repeated trial of experiments. The exact part which each performs is of no consequence. Nor does it matter that one has been experimenting long in vain, nor even that he may have made some actual advance toward the discovery to which he aspires. It is enough if the experiment which finally succeeds—

the one which demonstrates the practicability of accomplishing the end in view and indicates the means by which it is attainable—has been conducted under their united supervision, and in accordance with ideas and theories to which both have contributed."

In the case of DeLaski & Thropp Circular Woven Tire Co. v. William E. Thropp & Sons Co., 226 Fed. 941, Judge Woolley, speaking for this court said:

"In a machine containing as many elements as this one, it is not to be thought nor by the laws required, that the inventive conceptions of two inventors shall develop simultaneously. One may conceive a general or imperfect outline of an entirely novel thing, which without the conception of another developing it and giving it body, might never amount to invention; but if the conceptions of one supplement and complement the conceptions of the other, the result might be invention and therefore joint invention. 'When a claim covers a series of steps or a number of elements in a combination, the invention may well be joint, though some of the steps or some of the elements may have come as the thought of but one'. Quincey v. Krause, 151 Fed. 1012, 1017, 81 C. C. A. 290; American v. Wood, et al. (C. C.) 189 Fed. 391, 395. In this case we do not have to resolve doubts in favor of the patent under the rule which requires unquestionable proof that joint patentees are not joint inventors. United Shirt & Collar Co. v. Beattie, 149 Fed. 736, 741, Butler v. Bainbridge (C. C.), 29 Fed. 142, 143; Priestley v. Montague (C. C.) 47 Fed. 650, 651."

"It may be considered as well settled that in order to constitute persons joint inventors, it is not necessary that exactly the same idea should have occurred to each at the same time, and that they should work out together the embodiment of that idea in a perfected machine. One may be a joint inventor, even though the conception of the entire device may be due to another if he makes

suggestions of practical value which assisted in working out the main idea and making it operative, or contributes an independent part of the entire invention, which is united with the parts produced by the other and creates the whole." 48 Corpus Juris, 120 Sec. 134, citing many cases, among them Worden v. Fisher, 11 Fed. 505, 508. where Judge Brown said:

> "If an idea is suggested to one, and he even goes so far as to construct a machine embodying this idea, but it is not a completed and working machine, and another person takes hold of it, and by their joint labors, one suggesting one thing and the other another, a perfect machine is made, a joint patent may properly issue to them."

These extracts epitomize the authorities from text books and decisions on this subject.

The undisputed testimony shows that no one of the inventors had ever done any work in sound recording or reproducing prior to the time when they came together in 1918, pooled their interests and entered into an agreement to work together. This being true, they further agreed that no one of them would file an application in sound work in his own name which was natural and logical since they had agreed to work together, and since they were to work together, supplementing each others' ideas, work and experience, the arrangement among them as to filing applications was perhaps a wise one in order to prevent internal strife as to how much the invention in any case was due to any one of them. If they did so work, and the evidence shows that they did, they filed the application in the only way in which they legally could. All three of these men worked together every day during a number of years, and discussed matters relating to their work, sometimes in adjoining rooms and sometimes in the same room around the same table, conferring and exchanging ideas and using a

common note book, one suggesting and doing one thing and the other suggesting another thing, one supplementing the work of the other two. This related to the removal of the flywheel, to the photo-electric cell and the whole combination. "These inventions . . . we spoke about were made conjointly by the three inventors", said Dr. Engl.

While the testimony does not show the specific work which each co-inventor performed, nor the extent of it, yet it does show, and that without contradiction, that the three of them were jointly working together as one man daily, each contributing his part toward the invention.

True, it is, that the appellants introduced in evidence, over objection, an article purporting to be a review of some statements or comments alleged to have been made by one of the three, Vogt, to the effect that he had made three inventions, one of which was the German patent No. 387,058 which appellants contend is the same as the patent here involved. There was no testimony about this article and whether or not Vogt actually made any comments, and if he did just what they were, has not been legally established. The trial court admitted the article with the limitation that it was evidence only of its own existence and not of the truth of the statements therein contained. But Vogt is alleged to have written another article in 1926, Vol. 5, page 1641, in which it is stated with reference to the invention here that "the necessary labors were carried out" by him and his two associates "during the period from 1918 to 1924 in equal participation." This completely neutralizes the weight, if any, to be given to the earlier statements but in fact no weight should be given to either.

The appellants further allege that appellees tried to prevent them from securing certain facts from Vogt, but the record shows that they were trying to secure

facts which under the law of Germany they were not entitled to have, and that someone tried to bribe Vogt. A German court enjoined him from disclosing what he should not. There was a legal way for appellants to secure any information which Vogt had, and not only any information that Vogt could give them, but also any facts which Massole, the third joint inventor, knew, if they really had desired it, for neither Vogt nor Massole is in any way connected with the Tri-Ergon Corporation. His or their deposition could have been taken on notice or they could have been brought over here to testify at the trial, but appellants did neither, and so far as the record goes, they did not even attempt to do so. They chose rather to rest on inuendoes and insinuations. This does not overcome, first, the presumption of genuine joint invention by the three persons who signed the application and swore that they had jointly worked out the invention, and, second, the unequivocal testimony of Dr. Engl that they jointly invented the apparatus and methods here involved. Under any fair interpretation of the evidence and proper application of the law thereto, this defense must fail.

Another defense relied upon by appellants is that the United States patent is for the same invention as the German patent No. 387,058.

If this is so the application for the United States patent was not filed in time and it is accordingly invalid. In order to show that the inventions, though similar, are really very different, the appellees submitted an interlined copy of the claims in issue, together with the disclaimer, showing the features contained in the United States patent which were not disclosed in the German patent and also the features disclosed in the German patent but not claimed therein.

In claim 5 the patentees claim a *"toothed cylinder over a portion"* (of the periphery of which the ribbon

or film passes and) *"the teeth of said cylinder engaging"* . . . (the perforations of the ribbon) of *"said cylinder"*. The above quoted, interlined provisions are not contained in the German patent. This refers to the toothed cylinder "r" in Fig. 1. In the specifications this toothed cylinder is called a "sprocket" and the film passes over a portion of its periphery adjacent the translation point. At the same time the teeth of the cylinder engage in the perforations of the ribbon or film which moves uniformly by or over the translation point. The film is wrapped over or about a portion of this toothed cylinder adjacent the translation point, and the engaging of the perforations in the film with the teeth of the cylinder harness, as it were, the film to the flywheel so that the two move as one without any slippage. The German patent neither disclosed nor claimed a toothed cylinder nor any cylinder around which the film is thus wrapped to harness the film and flywheel. Instead the German patent discloses a pair of smooth rollers with which the film has a mere tangential contact which cannot operatively harness the flywheel and film to cause the film to move as one with the flywheel to give it the necessary uniformity of movement.

In claim 7, the combination includes a cylinder *"over a portion of the periphery of which"* the carrier passes, and a driving member *"coaxial with said shaft, a resilient connection between said driving member and flywheel and stop means for limiting the amount of yielding of said resilient connection"*. The German patent neither disclosed nor claimed the above quoted portions.

The "driving member" is the arm represented by the numeral 2 in Fig. 5 and is coaxial with the shaft that connects the "flywheel" and the "cylinder", "over a portion of the periphery of which" the film passes.

The "resilient connection" is the spring represented by the numeral 3 in Fig. 5 and is used between the flywheel and its driving member to prevent any irregularities in the motor, or gearing between the motor and the flywheel. The flywheel thus runs more uniformly and smoothly and imparts its own uniformity and smoothness of motion to the film.

The *"stop means"* for limiting the amount of "yielding" or stretching of the spring are represented by the numerals 5, 5 in Fig. 5. In starting and stopping the machine, the arm 2 pulls upon the spring and stretches it until the arm rests against the stops 5-5. After the machine gets up speed, the flywheel runs largely under its own momentum, the tension on the spring is released and it no longer comes into engagement with the stops. Thereafter the little power required to keep the flywheel running is transmitted to it through the spring.

Claim 9 is a method claim and refers to the translation of sound from a film record *"which comprises flexing the film arcuately longitudinally at the point of translation"* and rapidly and uniformly moving the film "in a circumferential direction" past said point.

The element of this claim not disclosed in the German patent is the arcuate bending feature of the film secured by passing the film over an arched or curved surface at the translation point. The important purpose of this longitudinal bending is to hold the film in exact focus for the recording and reproducing line of light which impinges on the film.

Longitudinal bending, as stated above, prevents the film from curling transversely, as it is naturally inclined to do, avoids depressions and keeps the sound track portion of the film in focus.

In claim 13 it is stated that *"the space between said lens and the film being free of obstructions to said light"*. This element not disclosed by the Ger-

man patent is directed to the idea that there is no physical slit or other obstruction between the lens projecting the light line and the film. If any obstruction were close to the film it would gather dirt and scratch the film and interfere with the transmission of the width of the light line as projected, such as would be caused by a mechanical slit.

In the disclaimer of claim 17, it is provided that *"a substantial portion of the periphery of the cylinder is in contact with the carrier in its travel from the intermediate point to said sprocket."*

This is not disclosed in the German patent and refers to the arrangement where the film lies in contact with a substantial portion of the periphery of the flywheel cylinder in the travel of the film from the translation point to the feeding sprocket as illustrated in Fig. 2 of the patent. The function of this element is to smooth out any small irregularities or vibrations that might otherwise be transmitted along the length of the film from the feeding sprocket to the translation point.

In claim 19 the film "is *yieldingly pressed into contact with a supporting area immediately adjacent the point of translation, such pressure cooperating with the inertia control in the elimination of irregularities in the film motion.*"

The feed sprocket may set up very fine irregularities in the length of the film between the feed sprocket and the translation point. This is prevented by the spring-pressed rollers dr^1 and dr^2 in Fig. 2 of the patent. This element is not disclosed in the German patent.

There are many features disclosed in the German patent which are not claimed and in law the patent stands as though the features were not disclosed. Davis-Bournonville Co. v. Alexander Milburn Co., 1 Fed. (2d) 227, 234.

All of the above mentioned elements, not disclosed in the German patent, coact with all the others in the combination. If they were eliminated, the results of the combination could not be obtained. It is evident that we have in this patent a combination and method not disclosed in the German patent.

All the other defenses have been considered, but we think that they are not substantial, and the decree is affirmed.

A true Copy:
Teste:

Clerk of the United States Circuit Court of Appeals for the Third Circuit.

[fol. 3] IN THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT, MARCH TERM, 1934

No. 5392

ALTOONA PUBLIX THEATRES, INC., Appellant,

vs.

AMERICAN TRI-ERGON CORPORATION and TRI-ERGON HOLDING, A. G., Appellees

Appeal from the District Court of the United States for the Middle District of Pennsylvania

This cause came on to be heard on the transcript of record from the District Court of the United States, for the Middle District of Pennsylvania and was argued by counsel.

On consideration whereof, it is now here ordered, adjudged, and decreed by this Court that the decree of the said District Court in this cause be, and the same is hereby affirmed, with costs.

Philadelphia, June 13, 1934.

Per Curiam.

Buffington, Circuit Judge.

Endorsements: Order Affirming Decree with Costs Rec'd & Filed June 13, 1934.

Wm. P. Rowland, Clerk.

[fol. 4] IN THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT, MARCH TERM, 1934

No. 5393

WILMER & VINCENT CORPORATION and LOCUST STREET REAL ESTATE COMPANY, Appellants,

vs.

AMERICAN TRI-ERGON CORPORATION and TRI-ERGON HOLDING, A. G., Appellees

Appeal from the District Court of the United States for the Middle District of Pennsylvania

This cause came on to be heard on the transcript of record from the District Court of the United States, for the

Middle District of Pennsylvania and was argued by counsel.

On consideration whereof, it is now here ordered, adjudged, and decreed by this Court that the decree of the said District Court in this cause be, and the same is hereby affirmed, with costs.

Philadelphia, June 13, 1934.

Per Curiam.

Buffington, Circuit Judge.

Endorsements: Order Affirming Decree with Costs. Rec'd & Filed June 13, 1934.

Wm. P. Rowland, Clerk.

[fol. 5] UNITED STATES OF AMERICA,
Eastern District of Pennsylvania,

Third Judicial Circuit, Set:

I, Wm. P. Rowland, Clerk of the United States Circuit Court of Appeals, for the Third Circuit, do hereby certify the foregoing to be a true and faithful copy of the original Transcript of Record (Volumes I and II) and proceedings in this Court in the cases of No. 5392, Altoona Publix Theatres, Inc., Appellant, vs. American Tri-Ergon Corp., and Tri-Ergon Holding, A. G., Appellees; No. 5393, Wilmer & Vincent Corp., and Locust Street Real Estate Co., Appellants, vs. American Tri-Ergon Corp., and Tri-Ergon Holding, A. G., Appellees, on file, and now remaining among the records of the said Court, in my office.

In testimony whereof, I have hereunto subscribed my name and affixed the seal of the said Court, at Philadelphia, this 6th day of July, in the year of our Lord one thousand nine hundred and thirty-four and of the Independence of the United States the one hundred and fifty-ninth.

Wm. P. Rowland, Clerk of the U. S. Circuit Court of Appeals, Third Circuit. (Seal United States Circuit Court of Appeals, Third Circuit.)

IN THE

UNITED STATES CIRCUIT COURT OF APPEALS,

FOR THE THIRD CIRCUIT.

No. 5392. March Term, 1934.

ALTOONA PUBLIX THEATRES, INC.,

Defendant-Appellant,

v.

AMERICAN TRI-ERGON CORPORATION AND TRI-ERGON HOLDING, A. G.,

Plaintiffs-Appellees.

No. 5393. March Term, 1934.

WILMER & VINCENT CORPORATION AND LOCUST STREET REAL ESTATE COMPANY,

Defendants-Appellants,

v.

AMERICAN TRI-ERGON CORPORATION AND TRI-ERGON HOLDING, A. G.,

Plaintiffs-Appellees.

OPINION.

(Filed August 6, 1934)

On Request to Change Opinion.

Before BUFFINGTON, DAVIS AND THOMPSON, *Circuit Judges.*

Per Curiam:

In the opinion heretofore filed in this case there were three inadvertences which all parties agree should be corrected.

1. On page 2, line 1 of the opinion we said: "This is an appeal from a decree of the district court."

Since there were two cases tried together below and argued together here, though disposed of in one opinion in the district court and here, the opinion should have read: "These are appeals from two decrees of the district court", and the opinion will be amended so to read.

2. On page 3, line 9, after the word "patentees" the words "do not" were omitted and should be inserted, so that the opinion will read when the insertion is made: "The patentees do not claim to be the first to have conceived this idea."

3. On page 5, line 21, we said the film traveled over the sound head at the speed of ninety feet "per second". Nowhere was this stated to be the fact. What was meant and what should have been said was ninety feet "per minute", for this accords with the fact, and the change will accordingly be made.

The appellants have requested that we change the following sentence on pages 11 and 12, of the opinion:

> "The appellants further allege that appellees tried to prevent them from securing certain facts from Vogt, but the record shows that they were trying to secure facts which under the law of Germany they were not entitled to have, and that someone tried to bribe Vogt."

The appellants say that "the implication, contrary to the record and the truth, is that someone connected with the defense, if not the appellants, tried to secure facts from Vogt, by bribing him". They suggest that the opinion be changed to read as follows:

> "The appellants further allege that appellees tried to prevent *some persons, not connected with the defense,* from securing certain facts from

> Vogt, but the record shows that they were trying to secure facts which under the laws of Germany they were not entitled to have, and that *they offered money to Vogt.*"

The appellees object to the change. But notwithstanding the objection, the change ought to be made if the sentence is not in accordance with the facts and was unnecessary.

Appellants in their brief in the cases on appeal before us said:

> "Therefore, in preparation for the Paramount case *we* made an investigation in Germany but the plaintiffs prevented *us* from getting the facts. However astonishing it may seem, plaintiffs' agent, Joy, in Germany at the time, not only threatened Vogt with fines and imprisonment if he disclosed the facts, but actually sued out an injunction on behalf of plaintiffs here to keep Vogt from telling the truth (I, 235-239). Joy brazenly admitted that the plaintiffs took these steps to prevent the information being obtained. Although Joy personally disclaimed any responsibility for it, it also appears that an option agreement was prepared at the same time in which Vogt 'would agree to restrain himself from disclosing anything in his files' (I, 239). This is a very bad showing for any litigant to make in a court of equity and we submit in and of itself is sufficient ground for dismissal. Courts of equity do not aid litigants who prevent the disclosure of evidence which is of such vital importance to their claims." (Italics ours.)

This was a very grave charge against the plaintiffs and it had to be a grave charge, and being printed in italics by appellants, was so intended, if it "in and of itself is sufficient ground for dismissal" of these cases. The gravity of this charge is such that it could not be passed over. If the charge thus made by defendants is true, it would have seriously affected the

integrity of the plaintiffs and would have had an important bearing upon the case when we came to consider the evidence, even though "in and of itself" it might not have been "sufficient ground for dismissal".

On the other hand, if untrue, the plaintiffs as a matter of right and justice should be vindicated. Otherwise they would continue to rest under this serious charge. Consequently, it was our duty to examine the record and state our conclusion.

John M. Joy testified that he had a conference with Mr. Hans Vogt in his laboratory in Berlin and Mr. Vogt referred to what appeared to be a "very disagreeable" subject to him. He said that members of the legal staff of Electrical Research Products Company of New York had approached him and "offered him a substantial amount of money" for permission "to use his files, in which he had recorded various laboratory experiments, or other matters that might be useful to them in connection with these suits over here." Joy said, "I told him (Vogt) that I thought it was a question of ethics on his part to even consider such a thing". He further said:

> "We took the matter up with our attorneys in Berlin and they advised me that in Germany it was a serious matter for a person who had been employed by a corporation or by an individual to at any time thereafter disclose anything which might be of benefit to a third party or which may have been private matters; and they advised that we apply to the Court for an injunction prohibiting Vogt from making such disclosures. And we did. And the Court granted an injunction and we did not even use it with Mr. Vogt, because I considered him a man of high character, and I did not believe that he would be so unethical as to go against his former associates."

This constituted the basis of the defendants' charge against plaintiffs in this case.

Joy further testified that their general counsel in Berlin said that he had read the court injunction to Vogt.

As to the connection of those transactions with the cases at bar, Joy said: "I have the names of the two gentlemen who made these overtures to Mr. Vogt, at least so he states". Whereupon counsel for appellants said: "Oh, there is no doubt about it. *We* tried our best to find out what the facts were, but they were concealed from *us*". (Italics ours.)

The record does not sustain the charge made in appellants' brief or show that appellees were trying to conceal anything which they did not have a legal right to conceal. On the contrary, the record does show that "someone" (we did not say and we do not know who, but Joy said that he had their names) offered Vogt a substantial amount of money for facts which a German Court enjoined him from disclosing. The charge made, and the uncontradicted evidence and admissions justify the sentence used in the opinion, and in view of these facts, it would be unjust to plaintiffs to change it.

Accordingly the request is denied.

A true Copy:
Teste:

Clerk of the United States Circuit Court of Appeals for the Third Circuit.

IN THE

UNITED STATES CIRCUIT COURT OF APPEALS,

FOR THE THIRD CIRCUIT.

No. 5392. March Term, 1934.

ALTOONA PUBLIX THEATRES, INC.,

Defendant-Appellant,

v.

AMERICAN TRI-ERGON CORPORATION AND TRI-ERGON HOLDING, A. G.,

Plaintiffs-Appellees.

No. 5393. March Term, 1934.

WILMER & VINCENT CORPORATION AND LOCUST STREET REAL ESTATE COMPANY,

Defendants-Appellants,

v.

AMERICAN TRI-ERGON CORPORATION AND TRI-ERGON HOLDING, A. G.,

Plaintiffs-Appellees.

ORDER CORRECTING OPINION OF THE COURT.

(Filed August 6, 1934.)

Plaintiffs having made application for the correction of obvious mistakes in the opinion heretofore filed in this case and the proposed correction having been consented to by the defendants and the defendants having proposed other changes which were opposed by the plaintiffs,

It is on this sixth day of August, 1934, ORDERED, ADJUDGED and DECREED as follows, that:

1. On page 2, line 1 of the opinion, the words, "This is an appeal from a decree of the district court" be changed to read, "These are appeals from two decrees of the district court".

2. On page 3, line 9, after the words "patentees" the words "do not" be inserted, so that the opinion will read, "The patentees do not claim to be the first", etc.

3. On page 5, line 21, the words "per second" be changed to the words "per minute".

4. The other changes requested are hereby denied.

PER CURIAM,
BUFFINGTON.

A true Copy:
Teste:

Clerk of the United States Circuit Court of Appeals for the Third Circuit.

SUPREME COURT OF THE UNITED STATES

October Term, 1934

No. 255

ALTOONA PUBLIX THEATRES, INC., Petitioner,

vs.

AMERICAN TRI-ERGON CORPORATION and TRI-ERGON HOLDING, A. G.

ORDER ALLOWING CERTIORARI—Filed November 5, 1934

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Third

Circuit is granted. And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.

SUPREME COURT OF THE UNITED STATES

October Term, 1934

No. 256

WILMER & VINCENT CORPORATION and LOCUST STREET REAL ESTATE CO., Petitioners,

vs.

AMERICAN TRI-ERGON CORPORATION and TRI-ERGON HOLDING, A. G.

ORDER ALLOWING CERTIORARI—Filed November 5, 1934

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Third Circuit is granted. And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.